THE INTELLIGENCE OF SCHOOL CHILDREN

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THE INTELLIGENCE OF SCHOOL CHILDREN

HOW CHILDREN DIFFER IN ABILITY
THE USE OF MENTAL TESTS IN SCHOOL GRADING
AND THE PROPER EDUCATION OF
EXCEPTIONAL CHILDREN

BY

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PUBLISHERS' NOTE

In *The Measurement of Intelligence* the author reduced the tests and the procedure for giving them to simple language, so that from a study of the book any careful student can be trained to use them. In the present volume he has done an even more significant thing, viewed either from the point of view of the teacher or from that of the principal or director responsible for administration. In this book he has set forth—in equally simple language, backed up by the results of a number of concrete studies, and illustrated by curves, tables, and descriptions of many individual pupils who have been tested and studied—the educational significance of intelligence, the great differences in the intelligence of school children, and what may be expected from and what ought to be done for pupils of different degrees of intellectual capacity.

A careful study of this book by teachers would contribute wonderfully to the intelligent handling of children, and the study of it by prospective teachers would open up entirely new conceptions as to educational procedure, and would lead to a far more satisfactory direction of the exceptional children found in every school. The book will also prove of much value to parents interested in the education of their children, and especially to those whose children vary much in either direction from the normal.

While written primarily for the teacher as such, and for parents interested in the mental development of their children, the book ought also to prove illuminating to principals and directors of schools generally, by suggesting to them more intelligent educational procedure in the classification and promotion of children and the administration of courses of study.

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PREFACE

This book has been written for the rank and file of teachers, school supervisors, and normal-school students. Its purpose is to illustrate the large individual differences in original endowment which exist among school children and to show the practical bearing of these differences upon the everyday problems of classroom management and school administration. It does not treat, except incidentally, the psychological principles underlying intelligence tests. Some of these problems the writer has touched upon elsewhere.[1] The technique of giving the tests of the revised Binet scale and the general significance of mental tests for education have been set forth in some detail in another volume of this series, *The Measurement of Intelligence*, which should be read in connection with the present volume.

In the preparation of this volume the writer has drawn heavily upon the data from investigations made by a number of his students at Stanford University. His debt to them is very great, not only for the generous way in which they have placed valuable data at his disposal, but if possible even more for the loyalty

[1] See Terman, Lewis M., *The Stanford Revision and Extension of the Binet-Simon Measuring Scale of Intelligence.* Warwick and York, Baltimore. 1917; pp. 179.

and enthusiasm with which they have worked together in carrying through coöperative undertakings of the most laborious nature. What a single individual working alone can accomplish in research with mental tests is well-nigh infinitesimal. Substantial progress can come only from the coöperative work of many on closely allied problems. This volume is in large measure the outcome of studies made by various members of the author's classes in intelligence tests during the years 1916–17 and 1917–18, the central topic for each year being the relation of school success to intelligence. Students who have contributed important data to the various chapters include the following:

Virgil E. Dickson (tests of first-grade pupils);

W. M. Proctor (tests of high-school pupils);

Irene Cuneo (tests of kindergarten children);

Margaret Hopwood Hubbard (tests of superior children);

O. S. Hubbard (tests of fifth-grade pupils);

Isabel Preston (analysis of discrepancies between mental age and school success);

J. K. Flanders (tests of Express Company employees);

H. E. Knollin (tests of unemployed, prisoners, and business men);

Dr. J. Harold Williams (tests of juvenile delinquents);

Lowery Howard and Virgil Dickson (tests of retarded children in the schools of "X" County);

Various students who coöperated in gathering the data on which the Stanford Revision of the Binet Scale was based. Among these were Dr. George Ordahl, Dr. Louise Ellison Ordahl, Grace Lyman, Neva Galbreath, and Wilford Talbert.

These studies are but parts of a larger investigation of mental growth and individual differences. Several of them are far from complete at the time of this writing. Hundreds of children who have been tested in the vicinity of Stanford University are being followed up in order to discover the value of mental tests as a means of forecasting the educational achievements possible to children of various degrees of intelligence. The investigation also involves the re-testing of a large number of children in successive or alternate years in order that typical curves of mental growth may be established. The writer believes that studies of this kind should entirely replace the controversial literature on the value of Binet and other mental tests. There is no other foundation for science, whether pure or applied, than positive, definitely verifiable facts. Psychology is no exception.

Another study should be mentioned in this connection, although circumstances prevent the publication of its results at present. With the assistance of a number of Stanford University students, the group intelligence scale devised for use in the United States Army was given during the school year of 1917–18 to approximately six thousand pupils from the third

grade to the senior year of high school. The purpose of the investigation was to secure data on the reliability of the army tests, and to this end a large amount of supplementary information regarding each pupil was secured for correlation with the tests results. This information included age, grade, years in school, nationality of parents, occupation of father, teachers' ratings of the children on intelligence, quality of school work, and several character traits. Approximately six hundred of the same pupils had been tested with the Stanford Revision of the Binet scale. In every respect the results of this investigation support the data and conclusions presented in the various chapters of this volume. The army tests, which were given to approximately 1,700,000 soldiers, demonstrated beyond question that the methods of mental measurement are capable of making a contribution of great value to military efficiency. That their universal use in the schoolroom is necessary to educational efficiency will doubtless soon be accepted as a matter of course.

The fact that the conclusions here offered are based chiefly upon results secured by the use of the Stanford Revision of the Binet-Simon tests must not be understood to imply that the writer looks with disfavor upon other intelligence scales. To the extent that the conclusions are valid at all, they can be confirmed by any system of tests which affords a reasonably accurate measure of general mental ability. However, it is not

the purpose of this volume to summarize the hundreds of interesting and valuable investigations which have utilized either Binet or other tests of school children. For the most part such investigations have been directed toward the improvements of methods. The writer's present aim is the more practical one of showing how the results of mental tests may be put to everyday use in the grade classification and in the educational guidance of school children.

The author is indebted to Professor R. M. Yerkes for reading several chapters of the manuscript and for many helpful criticisms.

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THE INTELLIGENCE OF SCHOOL CHILDREN

CHAPTER I

SOME PRINCIPLES OF INTELLIGENCE TESTING[1]

The Binet tests, a method of assaying intelligence. In order to find out how much gold is contained in a given vein of quartz it is not necessary to uncover all the ore and extract and weigh every particle of the precious metal. It is sufficient merely to ascertain by borings the linear extent of the lode and to take a small amount of the ore to the laboratory of an assayer, who will make a test and render a verdict of so many ounces of gold per ton of ore.

A half-century ago Francis Galton predicted that it would sometime be possible to obtain a general knowledge of the intellectual capacities of a man by sinking shafts, as it were, at a few critical points. Already Galton's dream is in process of realization, for in the last decade mental testing has become one of the most fruitful branches of psychological science. The credit for pointing the way belongs largely to the French psychologist, Alfred Binet, who, after more than fif-

[1] For a more extended discussion of the principles of mental testing, including detailed instructions for the use of the Stanford Revision of the Binet-Simon Intelligence Scale, see Terman, Lewis M., *The Measurement of Intelligence.*

teen years of patient research, gave to the world in 1908 the system of mental tests now known as the Binet-Simon Intelligence Scale. In various revised forms the method has come into general use in public schools, institutions for defectives, prisons, reform schools, and juvenile courts in the United States and in Europe. Our debt to Binet is very great, for he succeeded in bringing psychology down from the clouds and making it useful to men.

The Binet scale is made up of an extended series of tests in the nature of problems, success in which demands the exercise of the intellectual processes. As left by Binet, the scale consisted of fifty-four tests, ranging in difficulty from tests which are passed by the average child of three years, to tests which are difficult enough for the average adult. The Stanford Revision has increased the number of tests to ninety and has extended the scale far enough to measure the intelligence of superior adults.

The ninety tests in the revised scale constitute an extremely variegated series. This is necessary, since their purpose is to measure the subject's *general intelligence*, not his special ability in a particular line. They include tests of memory, language comprehension, size of vocabulary, orientation in time and space, eye-hand coördinations, knowledge about familiar things, judgment, ability to find likenesses and differences between common objects, arithmetical reasoning, resourcefulness and ingenuity in difficult practical situ-

ations, ability to detect absurdities, apperception, the speed and richness of association of ideas, the power to combine the dissected parts of a form board or a group of ideas into a unitary whole, the capacity to generalize from particulars, the ability to deduce a rule from connected facts, etc. Thus the tests give a kind of composite picture of the subject's general mental ability, and since standards of comparison have been established for each of the individual tests by trying it out on hundreds of unselected normal children of all ages, it is possible to express the total result of an examination in terms of "mental age" norms.

Why a mental test is significant. Are we justified in attributing real diagnostic significance to the little intellectual "stunts" called for by an intelligence scale? Some of these may even appear trivial. What does it signify, for example, whether a given ten-year-old subject names forty words or a hundred words in three minutes? Whether he puts together the parts of a form board in thirty seconds or in two minutes? Whether he defines thirty words or sixty words of a hundred-word list? Whether his definitions of words are stated in terms of "use" or in terms "superior to use"? Whether a series of five digits or only a series of three digits can be repeated backwards after a single auditory presentation? Whether there are three, two, one, or no successes in the attempt to draw a diamond-shaped figure from copy?

The secret lies in the standardization of the tests

upon normal children of different ages. Without such a standardization the tests would mean nothing. Standardization is coming to play the same rôle in psychology that it has long played in the various branches of applied science. The architect or bridge engineer plans his structure with constant reference to foot-pounds of strain which various materials will withstand. The physician analyzes a drop of blood and, by comparison of corpuscle count and hæmoglobin with the norms for health and disease, is able to render an important diagnosis. The psychologist working with mental tests may be compared with the palæontologist who finds in a gravel bed of some prehistoric age a skull cap, a fragment of jaw, and a broken humerus. Although the layman might not even recognize the human origin of such remnants, the palæontologist is able to tell us that the bones are those of a middle-aged male, that the species to which he belonged had not yet learned to stand erect, that he probably did not know the use of fire (worn teeth indicate that he subsisted on uncooked foods), that his intelligence was inferior (cranial contents only two thirds that of modern man), and that he had probably evolved but limited power of speech (diminutive points of attachment for the speech muscles). A little technical acquaintance with the standards of shape, size, and structure of human bones has transformed the meaningless fragments into a "missing link" — *Homo neanderthalensis.*

Perhaps no two things could be more alike to casual inspection than the balls of two thumbs; yet one who has been taught to read finger prints can ordinarily find from forty to seventy separate and individually sufficient points of identification. Just as many a man has been hanged on the evidence of his finger prints, so many an individual might safely be committed to an institution for the feeble-minded on the evidence of ten or a dozen intelligence tests which have been standardized according to age norms.

The meaning of mental age. Both the individual tests of the Binet scale and the scale as a whole have been standardized on the basis of age norms. The tests themselves are located in age groups in such a way as to bring it about that the *average* child of eight years will earn by the scale a "mental age" of eight years, the *average* twelve-year-old a "mental age" of twelve years, etc. Such an arrangement was arrived at empirically by trying out a series of tests upon hundreds of normal children of different ages. The Stanford Revision, for example, was based on tests of 1700 children and 400 adults.

To illustrate the use of the scale, let us suppose we are testing a child of eight years. If our subject passes successfully as far as the average child of eight years, we say that his mental age is eight years, or in this case normal. If he goes as far as the average ten-year-old, we say that he has a mental age of ten years. If he earns no more credit than the average six-year-old,

his mental age is six years. Binet merely took a standard of comparison which every one uses (namely, the standard of age) and made it definite by finding out what intellectual performances representative children of different ages are capable of.

It is necessary that the reader should at the outset arrive at a correct understanding of what the term "mental age" is and is not intended to signify. Two misconceptions are to be avoided:

1. That each "mental age" is a separate and qualitatively distinct level of mental attainment, contrasting markedly with both the mental age which precedes it and that which follows it. Such a use of the term is not in harmony with the facts. Mental development is consecutive and gradual. There is probably no mental power, capacity, or function which has a Minerva birth. The "faculty" in question develops first in rudimentary form, then grows gradually stronger and more definite until, by imperceptible stages, it reaches a state of maturity.

2. Another misunderstanding comes from the assumption that those who use the term believe a given mental age is a stage of development which all normal individuals pass through at the corresponding actual age. Such a belief would imply that at the age of ten years, for example, all children who do not belong to some special type (defective, genius, etc.) should be found at the ten-year mental age, eight-year children at the eight-year mental age, etc. It is one of the

main purposes of this book to show how widely children of a given age differ in mental age, and how greatly children of adjacent ages overlap each other in mental age.

The real meaning of the term is perfectly straightforward and unambiguous. By a given mental age we mean *that degree of general mental ability which is possessed by the average child of corresponding chronological age.*

Mental age a basis for school grading. The significance of mental age for the teacher lies in the fact that it can be used as a basis for grading the pupils so as to secure class groups of homogeneous ability. As will be shown in succeeding chapters, the pupils of given grades, or even the pupils of one grade in a single classroom, are far from equal in general intelligence or in ability to master the school work. Generally speaking, not far from a fourth of the pupils in any given grade have a mental level too low to make satisfactory work in that grade possible, while another fourth have reached a mental level which would enable them to succeed in a higher grade.

The intelligence quotient. The mental age merely indicates the level of development which a child has reached at a given time. Considered apart from chronological age it does not tell us whether a child is bright, dull, or average. Of three children all testing at the mental age of eight years, one might very well be exceptionally superior, one average, and one

feeble-minded. Such would be the case if their chronological ages were six, eight, and twelve years. In addition to an index of absolute mental level, we need an index of relative brightness. Such is the intelligence quotient (I Q), which is the ratio of mental age to chronological age. The six-year-old of eight-year mental age has an I Q of 8/6 or 133;[1] the twelve-year-old with a mental age of eight years, an I Q of 8/12, or 67. In computing the I Q of an adult subject, years of chronological age in excess of sixteen are disregarded, as the development of native intelligence seems practically to cease not far from this age.

An idea of how greatly school children differ in brightness is shown by the analysis of the I Q's of 1000 representative children in which it was found that:[2]

The lowest	1%	go to	70	or below, the highest	1%	reach	130	or above.
" "	2%	" "	73 "	" " "	2%	"	128 "	"
" "	3%	" "	76 "	" " "	3%	"	125 "	"
" "	5%	" "	78 "	" "	5%	"	122 "	"
" "	10%	" "	85 "	" "	10%	"	116 "	"
" "	15%	" "	88 "	" "	15%	"	113 "	"
" "	20%	" "	91 "	" "	20%	"	110 "	"
" "	25%	" "	92 "	" "	25%	"	108 "	"
" "	33%	" "	95 "	" "	33%	"	106 "	"

The intelligence quotient a basis for prediction. Just as mental age indicates the school grade in which a child normally belongs at a given time, so the I Q is the basis for prediction in regard to the child's later mental development. The possibility of such predic-

[1] More correctly, 1.33; but the decimal point is customarily omitted, the quotient being understood as expressed in per cent.

[2] Terman, Lewis M., *The Measurement of Intelligence.*

tion comes from the fact that the I Q has been found in the large majority of cases to remain fairly constant, at least for the ages between three or four and fourteen or fifteen. For illustration, we will take the case of a four-year-old child who is found to have a mental age of five years, and whose I Q is therefore 125. The probability is that this child will continue to have a mental age not far from 25 per cent above his chronological age, with the consequences which may be expressed as follows:

Chronological age	Probable mental age	Probable school ability
4 years	5 years	Upper kindergarten
6 "	7½ "	Second school grade
8	10	High fourth grade
10	12½	Low seventh grade
12	15	First year high school

It would, of course, be absurd to expect the I Q to maintain itself at an absolutely constant figure. Fluctuations occur for at least three reasons: (1) There may be in exceptional cases a certain amount of irregularity in the actual rate of mental development. (2) The results of a test may be influenced to some extent by the conditions under which it is given, the state of the child's health, his attitude toward the test, fatigue, and other temporary or accidental factors. Re-tests after a brief interval indicate that errors from this source are ordinarily not large. (3) There is inevitably a certain amount of error in every I Q rating, due to imperfections in the scale

used. If the scale has been so standardized that it yields mental ages which are too low, the I Q found will be too low; if the scale errs in the direction of being too generous, the resulting I Q will be too high. A scale may err in one direction at one level and in the opposite direction at another level. It was the most serious fault of the original Binet scale that in the lower range of tests it yielded mental ages which were too high, and in the upper range mental ages which were too low. The effect of such errors is greatly to exaggerate the amount of fluctuation to which mental growth is subject. It was the main purpose of the Stanford Revision to reduce these constant errors. Chapter XI shows in detail the degree of constancy which may be expected for the I Q when the Stanford Revision is used. While the law of constancy is subject to minor revisions, few things are more certain than the essential untruth of the widespread belief that mental development knows no regularity, and that the dullard of to-day becomes the genius of tomorrow. The fact is that, apart from minor fluctuations due to temporary factors, and apart from occasional instances of arrest or deterioration due to acquired nervous disease, the feeble-minded remain feeble-minded, the dull remain dull, the average remain average, and the superior remain superior. There is nothing in one's equipment, with the exception of character, which rivals the I Q in importance.

Effect of environment on the I Q. The question is

always raised whether, in estimating a child's intelligence on the basis of the I Q, it is not necessary to make allowance for the influence of social environment. For example, it is often argued that the child cannot know his age if he has never heard it, cannot read and report the memory passages if he has never attended school, cannot count from 20 to 1 if he has never been taught to count from 1 to 20, cannot name the days of the week or the months of the year unless he has heard others name them, and that therefore the I Q can have little significance except possibly as an index of the subject's social and educational environment.

It is, of course, true that an individual who for his entire life had been entirely deprived of human environment (assuming such a thing to be possible) could not pass a satisfactory Binet test, however normal his original endowment may have been. To use an extreme illustration, a child of ten years who had been reared in a cage, whose wants had been supplied while he was asleep, or by means of ingenious mechanical contrivances, who had never seen a human being, could hardly be expected to make a brilliant showing in defining words in the vocabulary test, detecting absurdities, repeating sentences, reading the Binet passage, answering comprehension questions, or naming sixty words. We may go further and assume that such a subject would be as little successful with the three-year as with the ten-year test.

Needless to say, the Binet scale was not intended for subjects of the type we have just described. Its use in a given case takes for granted that the ordinary and all but inevitable social contacts have been made, that the subject is not deaf or blind, and that he has had reasonable opportunity to learn the language in which the tests are given. Children who have attended school for any considerable time meet all of these requirements, whatever the social status of the home.

As a matter of fact, limited acquaintance with the language employed in the examination does not put the subject at great disadvantage in many of the tests. In some it does, and in testing subjects who are under this handicap the vocabulary test and a few others may very well be omitted. Following are two illustrations which show that the validity of the scale does not hinge entirely upon the subject's knowledge of English:

1. Kohs tested a Belgian refugee child of nine years who had been in America but two years. Although this child's acquaintance with the English language was very limited, the I Q earned on the Stanford-Binet scale was 99. The child was also doing school work of average quality in the fourth grade.

2. Dickson tested a Japanese boy, aged five years, two months, who had never attended school and who had had little opportunity to learn English; yet this boy earned a mental age of seven years and an I Q of 133.

That lack of schooling does not prevent a subject from earning an average or superior score in the test is shown by the cases of S. S. and Gypsy Mary.

S. S. was tested at the age of seven years. He had never been to school, and although his home advantages were excellent, he had had no formal instruction and had never learned to read. The parents believed, perhaps rightly, that the important needs of childhood, apart from simple moral instruction, are food, fresh air, and freedom for play. Nevertheless, S. earned a mental age of ten years, eight months, and an I Q of 153.

In 1916 a gypsy girl of sixteen years was given the Stanford-Binet test in a clinic in Oakland, California. This girl had been stolen by the gypsies when she was about four years old, had lived with them continuously until a few days before the test was made, and had never attended a school. The I Q found was approximately 100.[1]

It is not denied that the cultural status of the home (even apart from heredity) may affect the result of the test to some extent, although the influence has never been accurately determined. If it were considerable,

[1] The girl had run away from the gypsies and had told of being kidnaped by them when a child. The gypsies denied her story and stated that she was weak-minded and not responsible for what she said. The mental test was given to determine her competence. As a result of her testimony, she was freed from her gypsy parents and returned to her home State (Montana), where she was placed in school. Within a year she had completed the work of several grades and was ready to enter high school.

we should find a marked rise of I Q in the case of children who had been removed from an inferior to a satisfactory home environment. Our data on this point are not extensive, but of a dozen or more children of this kind whom we have re-tested, not one showed improvement. Two such children, Walter and Frank, have been under observation for several years. Until the ages of five and seven years they lived in an exceptionally poor home. The mother was dull, the father illiterate and a drunkard. Both of the parents died within a year and the boys were adopted by a woman of decidedly more than average ability who treated them as her own sons. At the time of adoption one tested at 73, the other at 82. Four years later the I Q's were 70 and 77. It is a general rule that children of border-line intelligence improve little if at all in I Q as they get older, notwithstanding their increased school experience and the extra attention they receive in special classes.

That the environment of the home affects the result of the test but little is further shown by the fact that occasionally in a very inferior home all of the children except one test low, as would be expected, while that one tests exceptionally high. In one such family (Portuguese) there are three children who test between 76 and 88, while a brother of these tests at 130. The latter is making a very superior record in high school, which he entered at the age of thirteen years. The others have not been able to complete the eighth

grade. All have had the same home environment and the same educational opportunities.[1]

Scales for group testing. To test each year the intelligence of all the children by the Binet method would involve a larger task than the school is likely to undertake. There is accordingly a wide field for tests which can be applied to an entire group, or class, at once. The various scales have been devised for this purpose. The group scales are given as written tests and can be applied to an entire class of fifty or more pupils in about an hour. To score the records requires about ten minutes for each pupil, or a total of about five or six hours for a class of average size. This can be done evenings or at odd times. Most group scales have the advantage of requiring little special psychological training either for giving the tests or scoring them. An unfortunate limitation of such scales is that they are not satisfactory in the lower grades where the need for testing is greatest. As measures of intelligence they are probably somewhat less accurate than scales for individual testing, but their obvious advantages make them deserving of wide use with pupils of the upper grades and high school.[2]

However, no group scale will ever do away with the necessity of individual testing. Rather it makes the need for individual testing more obvious. All the

[1] The mental growth curves of two of these children are shown in Fig. 24, p. 156.

[2] The Otis Group Tests and the instructions for using them are supplied by the publishers of this book.

pupils in the fourth grade and beyond should be given a test by the group method every year, and those whose scores are either very high or very low in the group examination should be given a Binet test. As will be shown later (chapter IV), it is highly desirable that every pupil be given a mental test within the first half-year of his school life.

CHAPTER II

AMOUNT AND SIGNIFICANCE OF INDIVIDUAL DIFFERENCES[1]

Individual differences exist for all traits. When many unselected children of a given age are examined for any trait, large individual differences are found. This is true whether the trait in question is height, weight, strength, lung capacity, number of blood corpuscles, hearing, vision, intelligence, courage, conscientiousness, social adaptability, vanity, or any one of a hundred others. Figures 1 to 5 illustrate typical individual differences among school children in sense of humor, cheerfulness, evenness of temper, quality of school work, and ability to give sustained attention. The graphs show the per cent of pupils who were classified by their teachers as "very inferior," "inferior," "average," "superior," or "very superior" in regard to each of the traits.

The above graphs represent the distribution of teachers' ratings; that is, estimates based on personal observation of the pupils rated. Actual measurement of the traits would have been preferable to ratings, had such measurement been possible, but there are

[1] For a more extended discussion of individual differences see E. L. Thorndike, *Educational Psychology*, vol. III (1914), pp. 141–308. Teachers College, Columbia University, New York City.

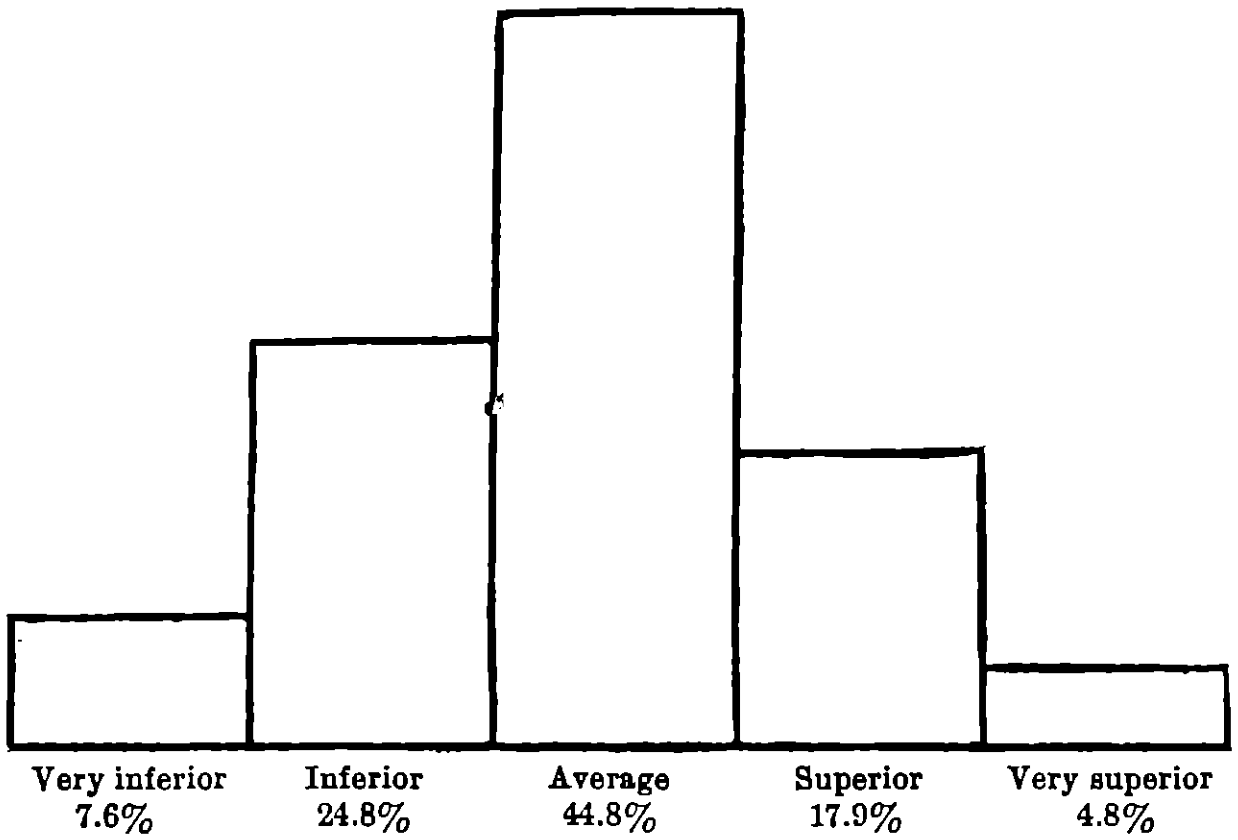

FIG. 1. INDIVIDUAL DIFFERENCES AMONG 145 FIRST-GRADE CHILDREN IN SENSE OF HUMOR. (*Teachers' ratings.*)

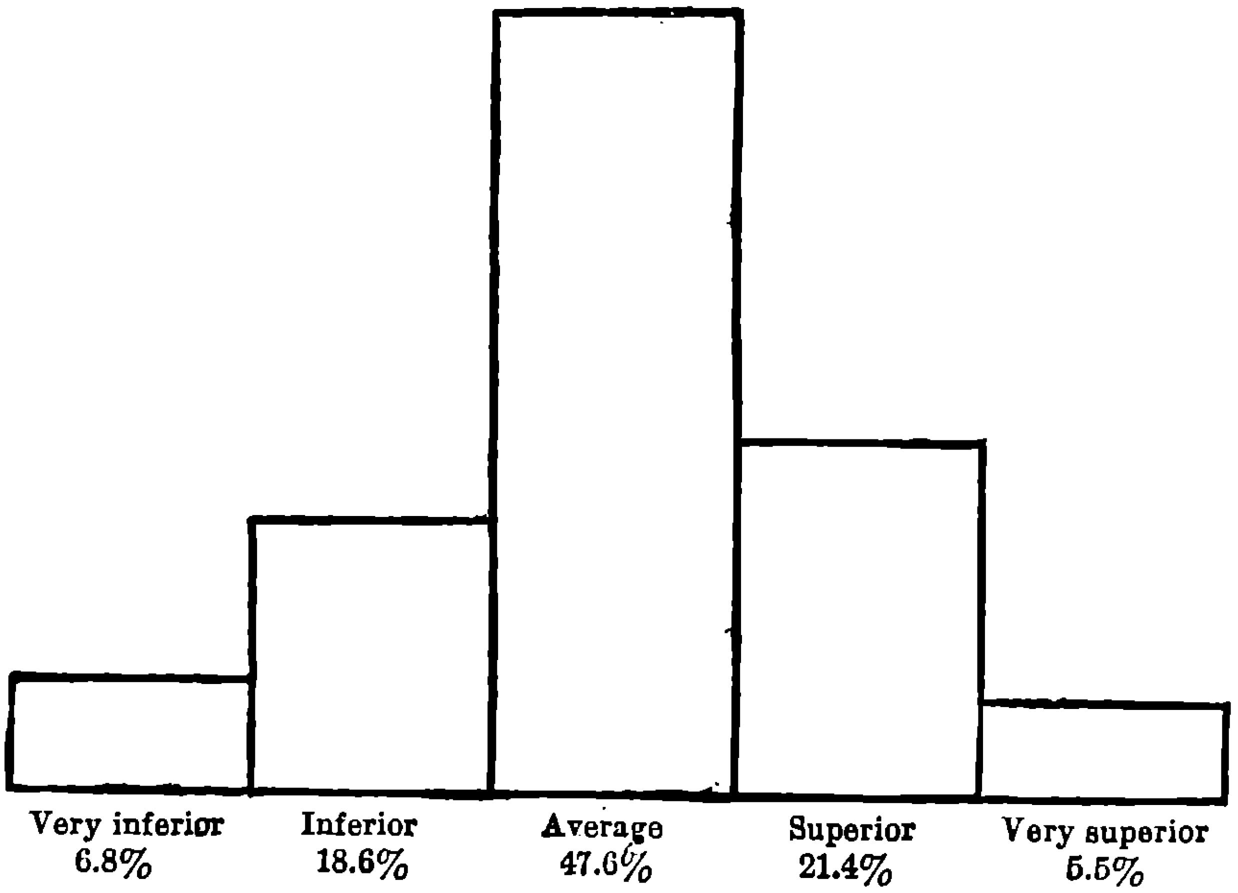

FIG. 2. INDIVIDUAL DIFFERENCES AMONG 145 FIRST-GRADE CHILDREN IN CHEERFULNESS. (*Teachers' ratings.*)

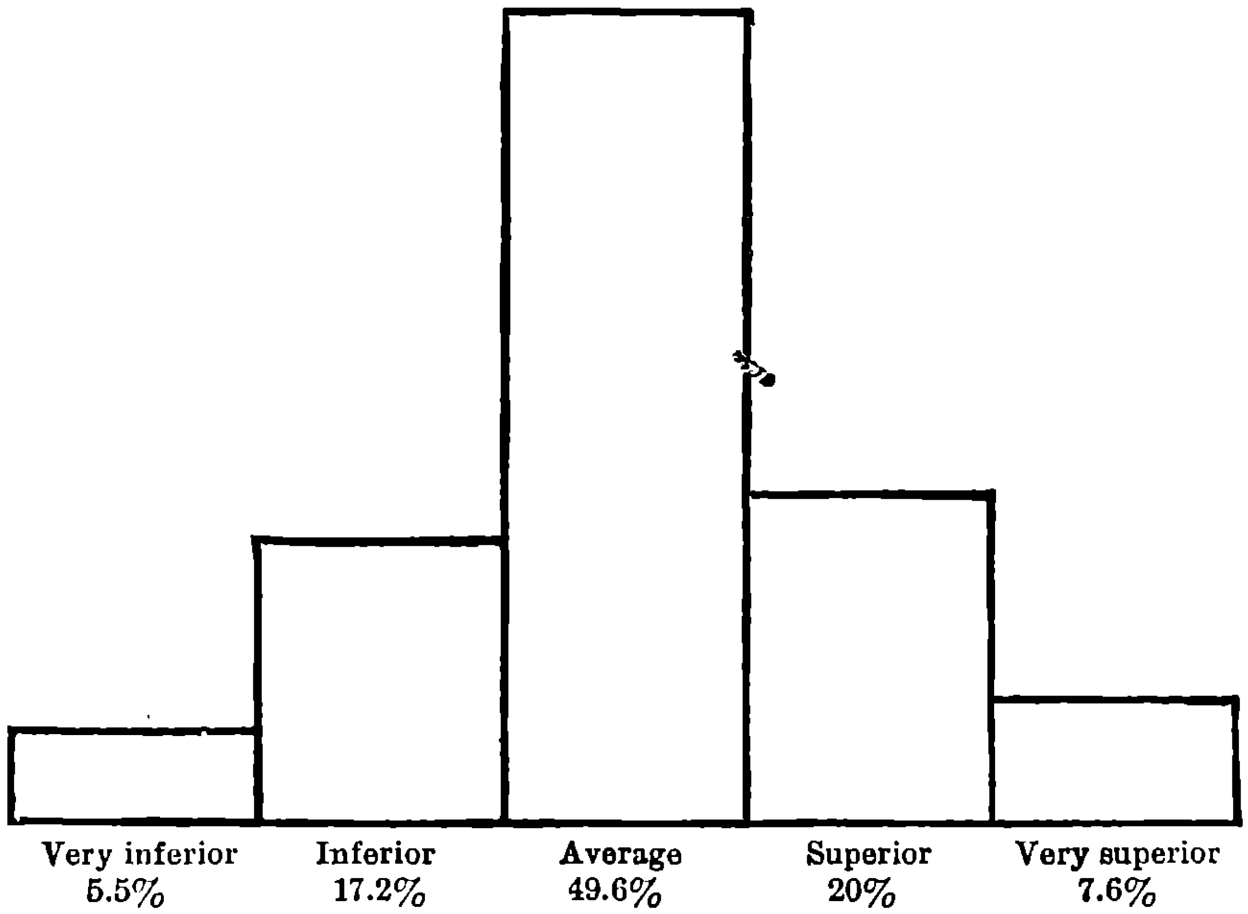

FIG. 3. INDIVIDUAL DIFFERENCES AMONG 145 FIRST-GRADE CHILDREN IN EVENNESS OF TEMPER. (*Teachers' ratings.*)

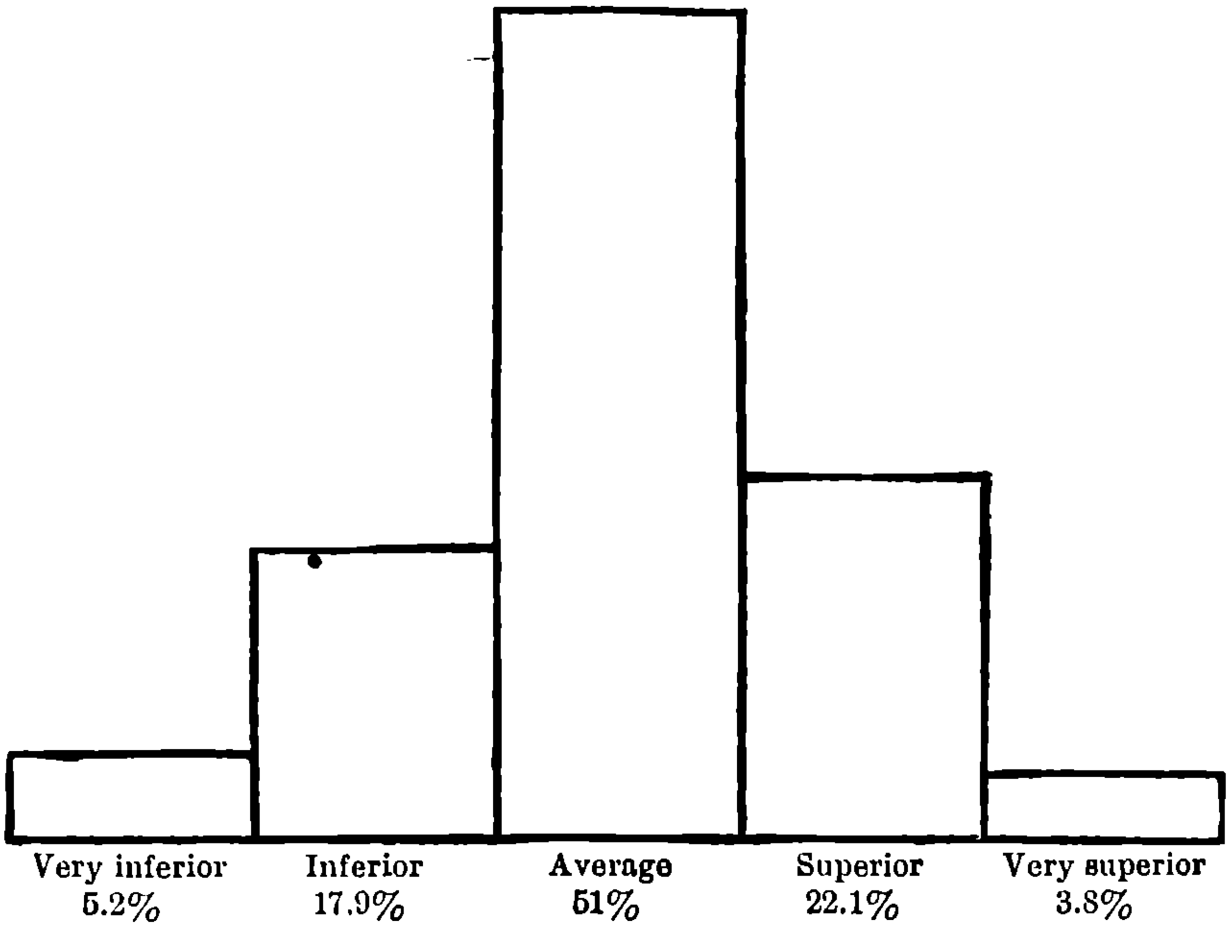

FIG. 4. INDIVIDUAL DIFFERENCES AMONG 503 CHILDREN IN QUALITY OF SCHOOL WORK. (*Teachers' ratings.*)

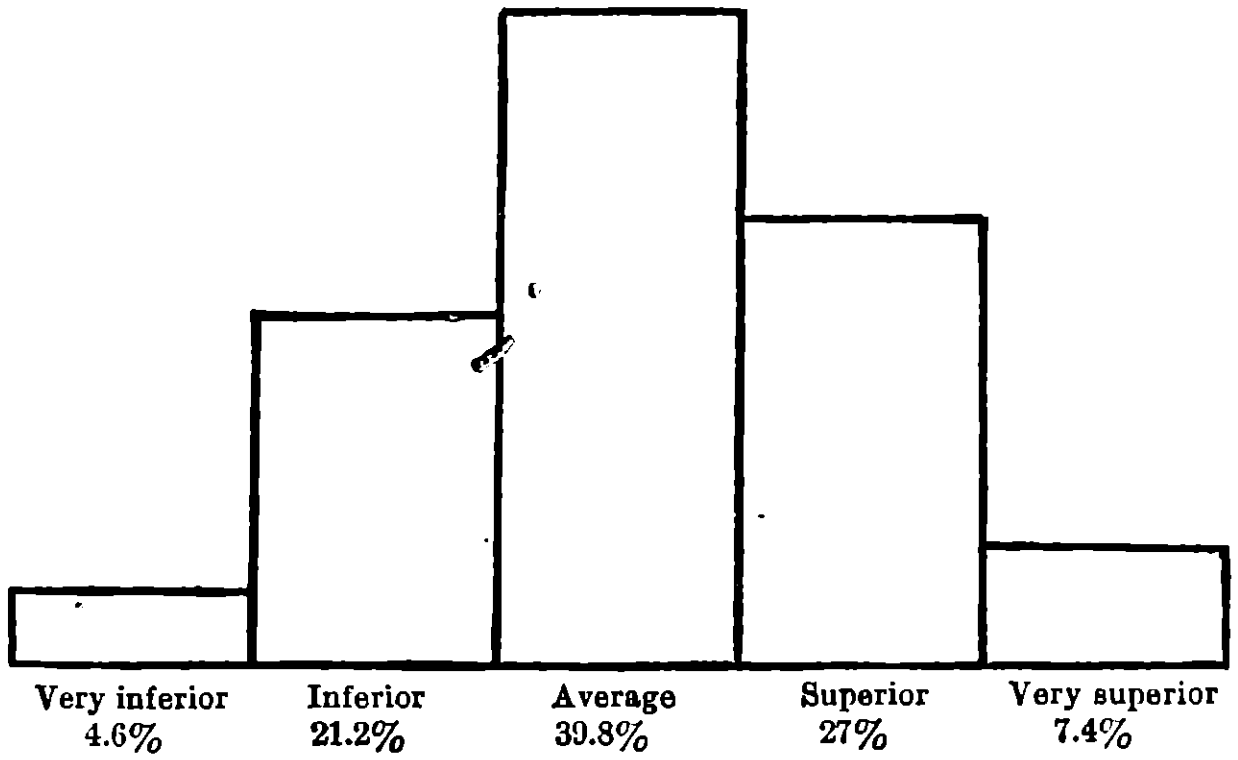

FIG. 5. INDIVIDUAL DIFFERENCES AMONG 392 CHILDREN, FIRST TO EIGHTH GRADE, IN ABILITY TO GIVE SUSTAINED ATTENTION. (*Teachers' ratings.*)

still many domains of mind and character for which measuring scales have not been devised.

It may be argued that the individual differences represented in the above graphs are spurious; that they merely reflect the varying degrees of error in the judgments of those who furnished the ratings. It is an extremely significant fact, however, that whenever we succeed in devising a method for actually measuring a mental trait, as large individual differences are found for it as for such physical traits as height or weight. The latter are of course susceptible of as accurate measurement as practical purposes are likely to demand. The progress of children through the grades of a school system can be measured in terms of age-grade status with sufficient accuracy. In the case

of intelligence, also, the individual differences can be measured; perhaps less accurately than height, yet far more accurately than they can be estimated on the basis of common observation. Figure 6 illustrates typical differences among ten-year-old boys in height; Figure 7, typical differences among ten-year-old boys in ability to win promotions in school; Figure 8, typical differences among twelve-year-old boys in I Q; and Figure 9, typical differences among 1458 children as shown by teachers' ratings for intelligence. Attention is directed to the fact that individual differences are equally in evidence for the four traits.

The causes of individual differences in school progress. In the case of a physical trait such as height, perhaps few would deny that the differences found represent in the main differences in original endowment. That the progress children make through the grades of a school system is also chiefly dependent upon original endowment is neither so obvious nor so generally believed. The common opinion seems to be that nearly all children are capable of satisfactorily accomplishing eight grades of school work in eight years, and that if they fail to do so it is because of faulty school management. The remedies most often proposed for the prevention of retardation are better attendance laws, school census reform, extension and improvement of medical inspection, flexible grading, and adaptations of the course of study.

That reform in all these lines is needed, for other

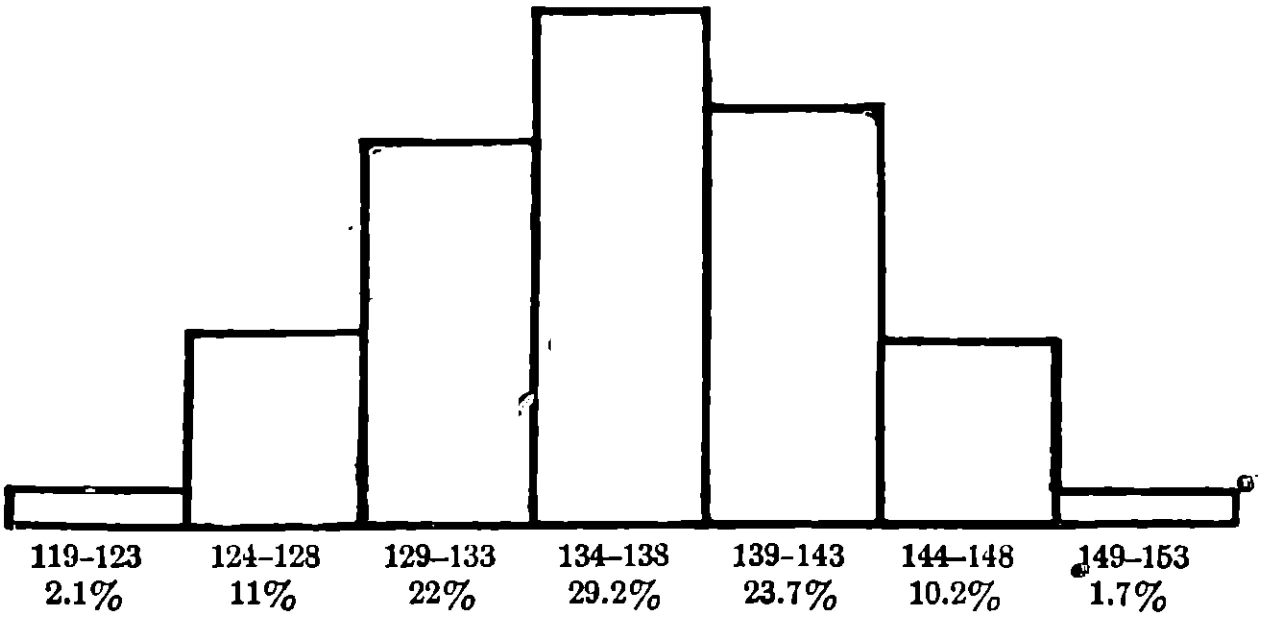

FIG. 6. INDIVIDUAL DIFFERENCES IN HEIGHT AMONG 236 BOYS, AGED 9½ TO 10½ YEARS. (*Baldwin.*)

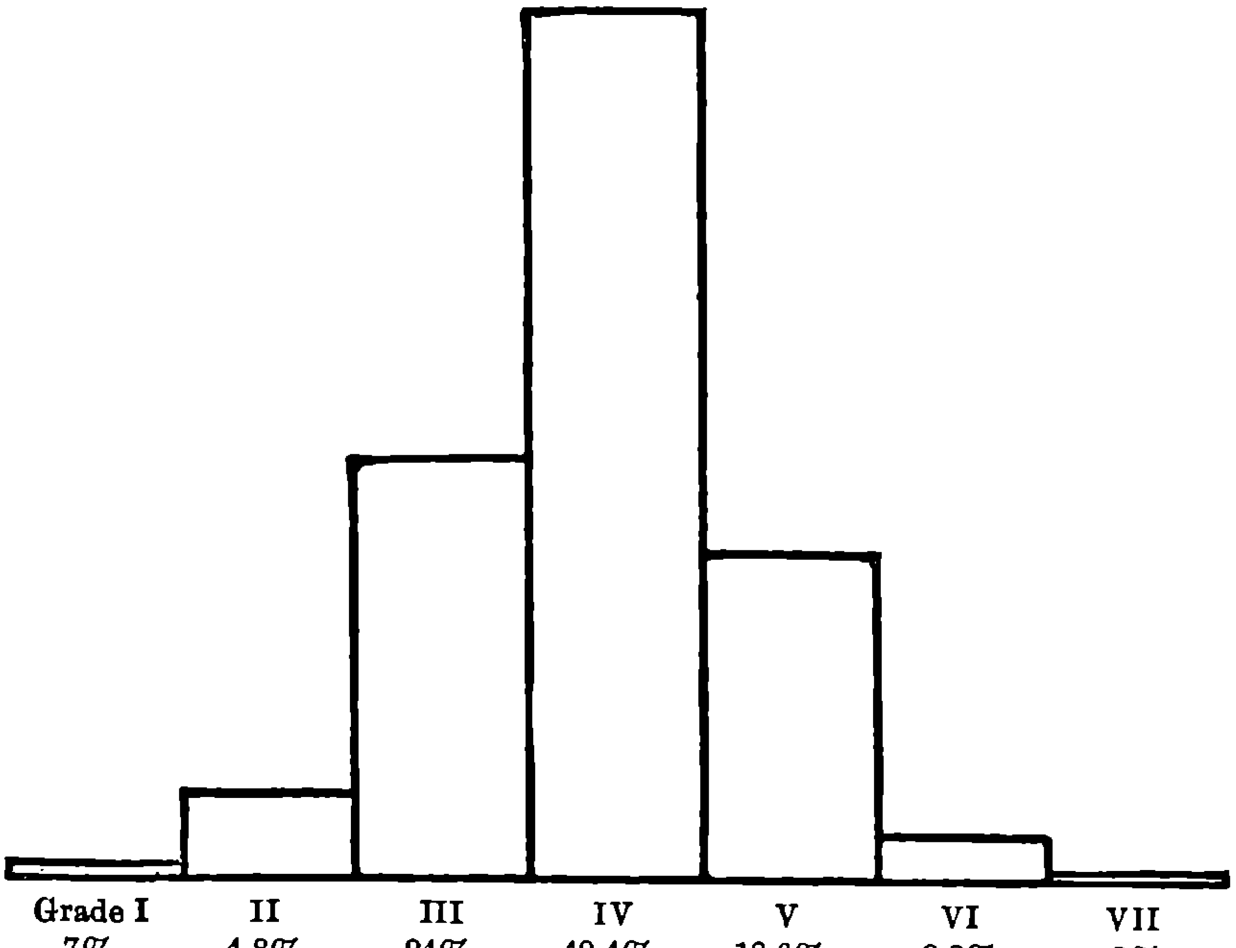

FIG. 7. INDIVIDUAL DIFFERENCES AMONG 1896 TEN-YEAR-OLD BOYS IN ABILITY TO WIN PROMOTIONS IN SCHOOL. (*Shows grade location of ten-year-old boys in Salt Lake City, May, 1915.*)

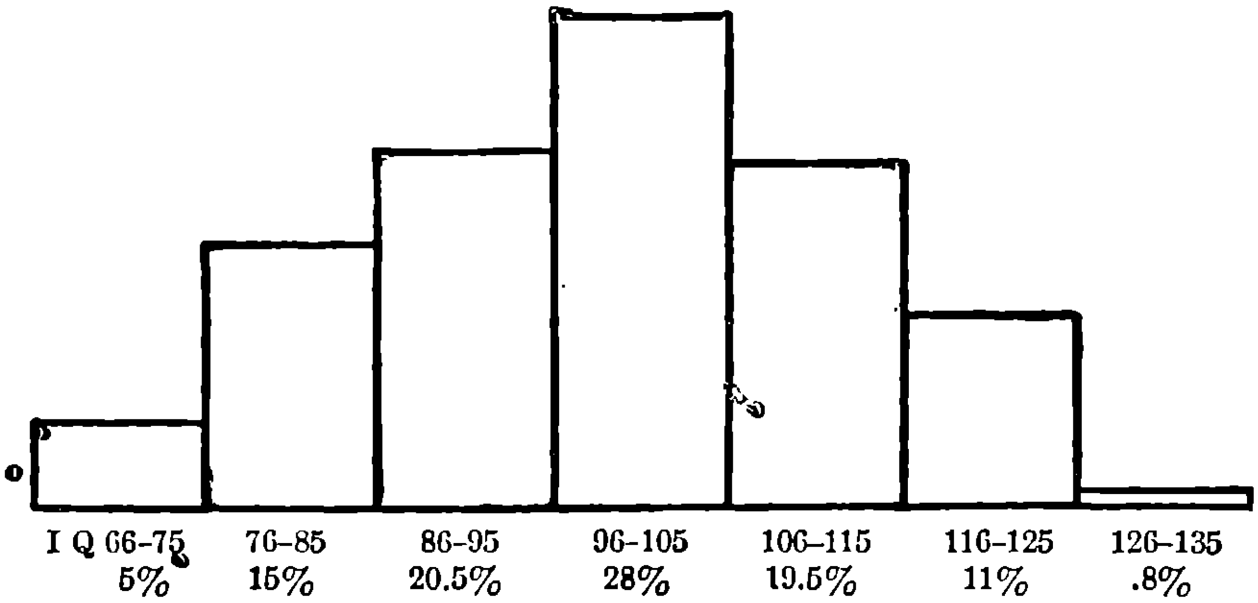

FIG. 8. INDIVIDUAL DIFFERENCES AMONG 83 UNSELECTED 12-YEAR-OLD CHILDREN IN I Q AS MEASURED BY THE STANFORD-BINET SCALE

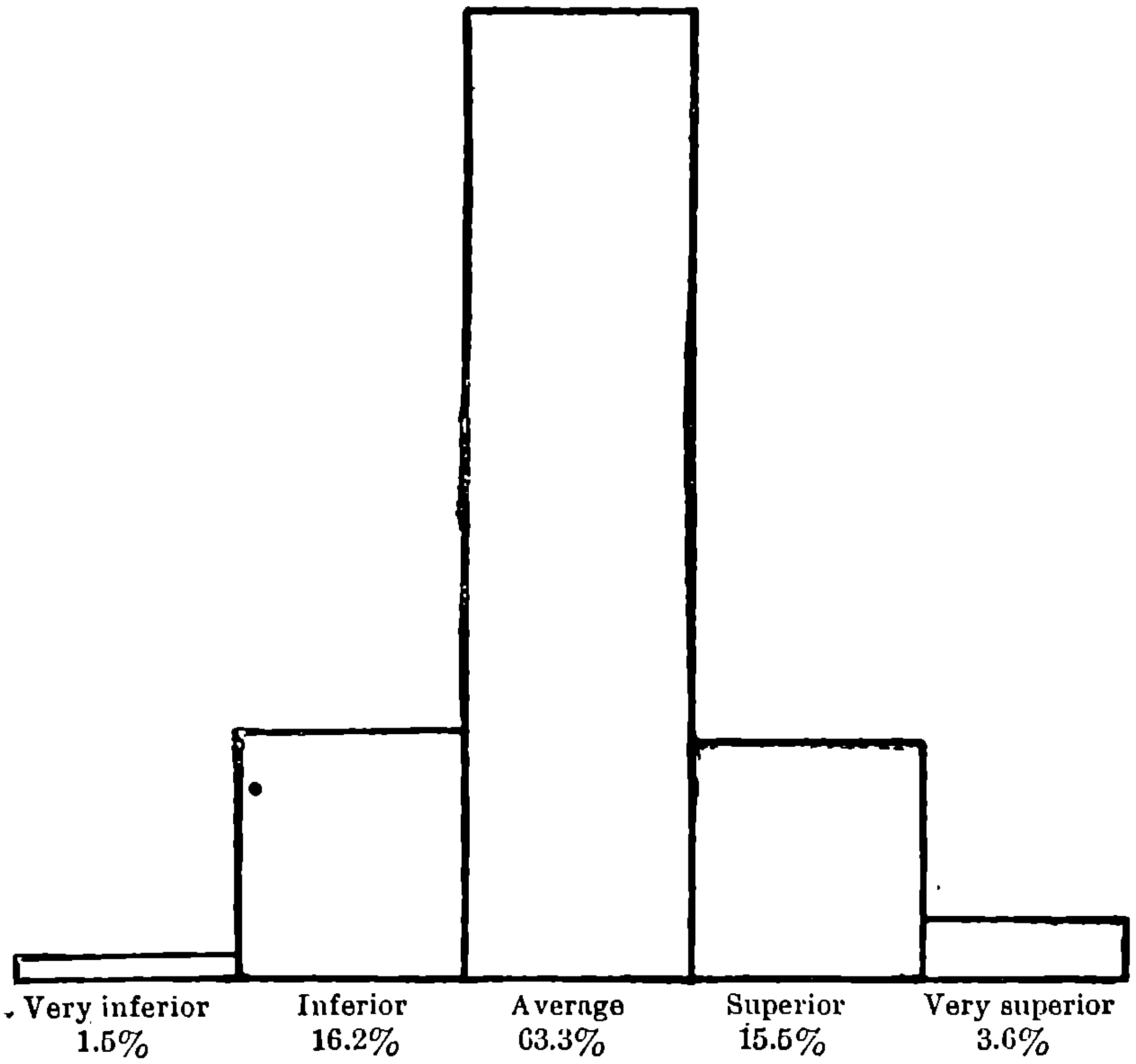

FIG. 9. INDIVIDUAL DIFFERENCES IN INTELLIGENCE AMONG 1458 CHILDREN, GRADES V TO VIII. (*Teachers' ratings.*)

reasons as well as for the reduction of retardation, will be admitted by all. We are beginning to learn, however, that all of these measures combined are powerless to reduce greatly the number of over-age children in the grades. Notwithstanding the persistent campaign which has been waged against the evils of retardation for the last dozen years, the number of retardates remains to-day much the same as it was when the campaign began. We are justified in raising the question whether the most important cause of retardation has been located, and whether it is one that can be removed.

In the various chapters of this book certain data from intelligence tests will be analyzed in the attempt to formulate an answer to the above question. The facts which will be presented point fairly definitely to the conclusion that the differences which have been found to exist among children in physical traits are paralleled by equal differences in mental traits, particularly intelligence. It will be shown that these innate differences in intelligence are chiefly responsible for the problem of the school laggard; that the so-called "retarded" children on whom we have expended so much sympathy are in reality nearly always *above* the grade where they belong by mental development; and that the real retardates are the under-age children, who are generally found from one to three grades *below* the location which their mental development would warrant. In other words, it will be shown that

the retardation problem is exactly the reverse of what it is popularly supposed to be.

Overlapping of mental ages in the different grades. The extent of the school's failure to grade children according to their ability will be evident from an examination of Figure 10, which shows the actual distribution of mental ages disclosed by the Stanford-Binet scale in the first grade, the fifth grade, and the first year of high school in typical public school systems of California. It will be seen that not only do the first-grade children greatly overlap those of the fifth grade, and fifth-grade children those of the first year of high school, but that the brightest child in the first grade has all but reached a point in mental ability corresponding to that of the lowest pupil in the high school. The brightest of the fifth-grade pupils is above the median mental level for the first year of high

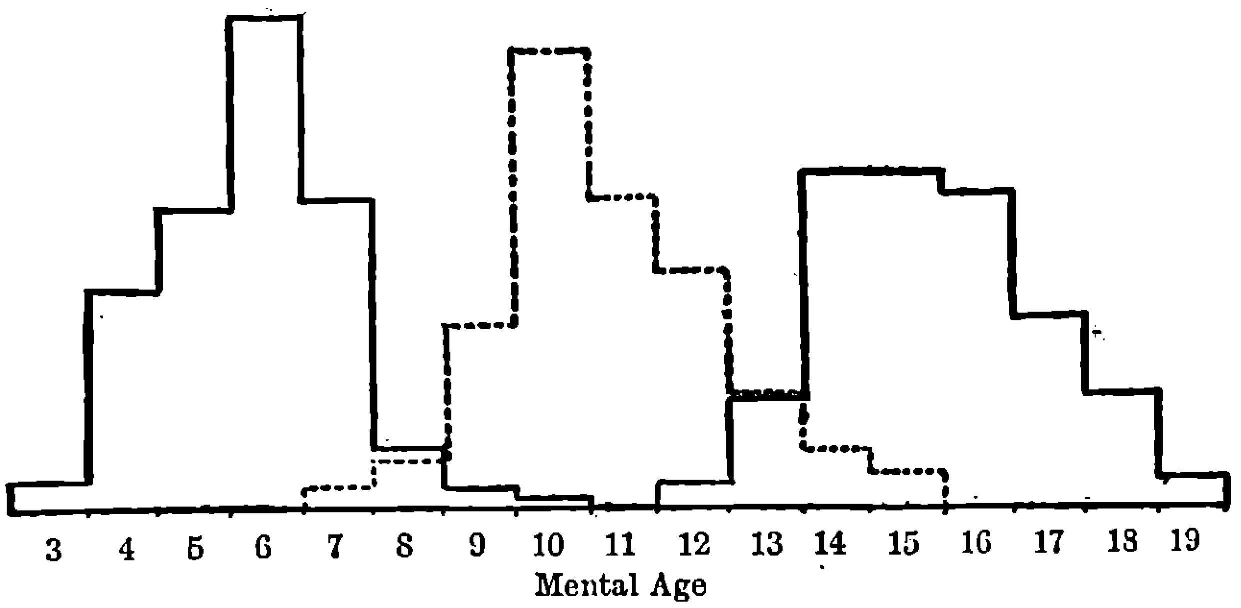

FIG. 10. OVERLAPPING IN THE MENTAL AGES OF CHILDREN IN THE FIRST, FIFTH, AND NINTH GRADES

school, and the brightest of the first grade reaches the median for the fifth grade.

That there are children in the first grade as old chronologically as the youngest in the eighth grade is generally understood and deplored, but few teachers are aware of the fact that mental ages are scattered through the grades hardly less promiscuously. Table 1 shows the grade distribution *by mental age* of 676

Mental Age	Grade Attended							
	I	II	III	IV	V	VI	VII	VIII
7-6 to 8-5	25.5 %	56.6 %	18.4 %					
8-6 to 9-5	4 %	24.5 %	49 %	19.4 %	1 %	1 %	1 %	
9-6 to 10-5		3.8 %	28.5 %	46.6 %	14.2 %	5.7 %	.9 %	
10-6 to 11-5			7 %	23 %	44.6 %	20 %	3.5 %	1.2 %
11-6 to 12-5			1 %	8.3 %	19.8 %	41.1 %	16.6 %	12.5 %
12-6 to 13-5				2.6 %	9 %	37.1 %	24.3 %	27 %
13-6 to 14-5			1.5 %		6 %	31 %	23.5 %	38.2 %

Table 1. Distribution in the Grades of 676 Unselected Children

By "7-6" is meant 7 years and 6 months. This form of expression will be used throughout in both text and tables.

unselected pupils below the high school who are mentally eight years old or older.

The failure of school grading to give groups of homogeneous chronological age is a matter of hardly any importance compared with its failure to give groups of homogeneous mental ability. The chronologically old and the chronologically young may and often do belong together, the mentally old and the mentally young do not. Notwithstanding the sifting which takes place at the end of each school year, the resulting classification of children has been so far from successful that, generally speaking, the lowest 25 per cent of pupils in any grade belong mentally in a lower grade and the highest 25 per cent in a higher grade. Only the middle half are classified approximately where they should be. Usually more than 15 per cent are at least two grades removed from the one in which they belong by mental age.

The tendency to promote by age. It was stated in an earlier part of this chapter that the grade progress of the school child is governed largely by original endowment. However, facts such as those just presented show that endowment is by no means the sole factor; for if it were, children would be more correctly graded according to ability. The other factor is the persistent tendency of teachers to promote by the calendar. The dull are allowed to become somewhat retarded, but are nevertheless promoted beyond their ability to do the work. Occasionally the brightest are allowed to become accelerated, but comparatively rarely, and almost never as much as they deserve.

Here are two children, both in the fifth grade, who offer a typical illustration:

A. Boy; age 14–3; mental age 8–6; I Q 60; years in school seven and a half; quality of school work "very inferior"; grade status on the usual basis of reckoning, retardation of three years. In reality this boy is accelerated two years, for his mental level of 8½ is at least two years below that necessary for satisfactory work in the high fifth grade.

B. Girl; age 9–8; mental age 13–1; I Q 130; years in school three; quality of school work "very superior"; grade status reckoned on the usual basis, two years acceleration. This girl is not really accelerated, but retarded, for her mental level of 13 years would enable her to do average work in the seventh grade.

The one criterion of fitness for promotion should be ability to meet the requirements of the next higher grade. Pupils of the type of Child A, kept always at tasks that are hopelessly beyond their ability, never learn the meaning of success. Those like Child B miss the mental and moral stimulus which comes from intense application to tasks commensurate with ability. We see how badly misplaced any measure of reform would be which was designed merely to "prevent retardation," in the usual sense of that term.

But what is the solution of the problem of over-age children? Are they to be required to repeat more grades than they now do? Would not the policy of rigidly holding these children in the grade corresponding to mental age be even more discouraging than the present practice of over-promoting them? It would

be unfortunate indeed if we were obliged to choose between the two evils. Perhaps another solution is possible if we will only cease to think exclusively in terms of cross-section education. Instead of a single curriculum for all, merely divided into eight successive levels, it would be better to arrange parallel courses of study for children of different grades of ability. Some such solution seems necessary if we are to adjust school work to the abilities of the children and at the same time avoid the admittedly serious evils of repetition.

CHAPTER III

INDIVIDUAL DIFFERENCES AMONG KINDERGARTEN CHILDREN[1]

TESTS were made by Miss Cuneo of 112 children attending five kindergarten classes in the cities of San Jose and San Mateo, California. The majority of the pupils came from middle-class homes, a few from each extreme of the social scale. All were American born. The ages were as follows:

	$3\frac{1}{2}$–4	4–$4\frac{1}{2}$	$4\frac{1}{2}$–5	5–$5\frac{1}{2}$	$5\frac{1}{2}$–6	6–$6\frac{1}{2}$	$6\frac{1}{2}$–7	Total
Boys	5	9	11	12	20	6	1	64
Girls	4	7	9	14	11	2	1	48
Total	9	16	20	26	31	8	2	112

Range in mental age. Although the total range of actual ages was from $3\frac{1}{2}$ to 7 years, all but 19 of the pupils were between 4 and 6. As will be seen from Table 2, the range in mental age was greater than this; namely, from 3–4 to 7–7. Of the 112 pupils, 5 were mentally below 4 years, 35 between 6 and 7, and 3 above 7. The kindergarten group all but overlaps in

[1] Written with the assistance of Irene Cuneo.

mental age the fifth-grade group described in chapter V. The highest mental age found in the kindergarten was 7–7, the lowest in the fifth grade 7–9. The chances are that if twice as many had been tested an actual overlapping would have been found.

Mental age	3 to 3-5	3-6 to 3-11	4 to 4-5	4-6 to 4-11	5 to 5-5	5-6 to 5-11	6 to 6-5	6-5 to 6-11	7 to 7-5	7-6 to 7-11	Total
Number	3	2	11	24	17	17	19	16	2	1	112

TABLE 2. MENTAL AGES OF 112 KINDERGARTEN CHILDREN

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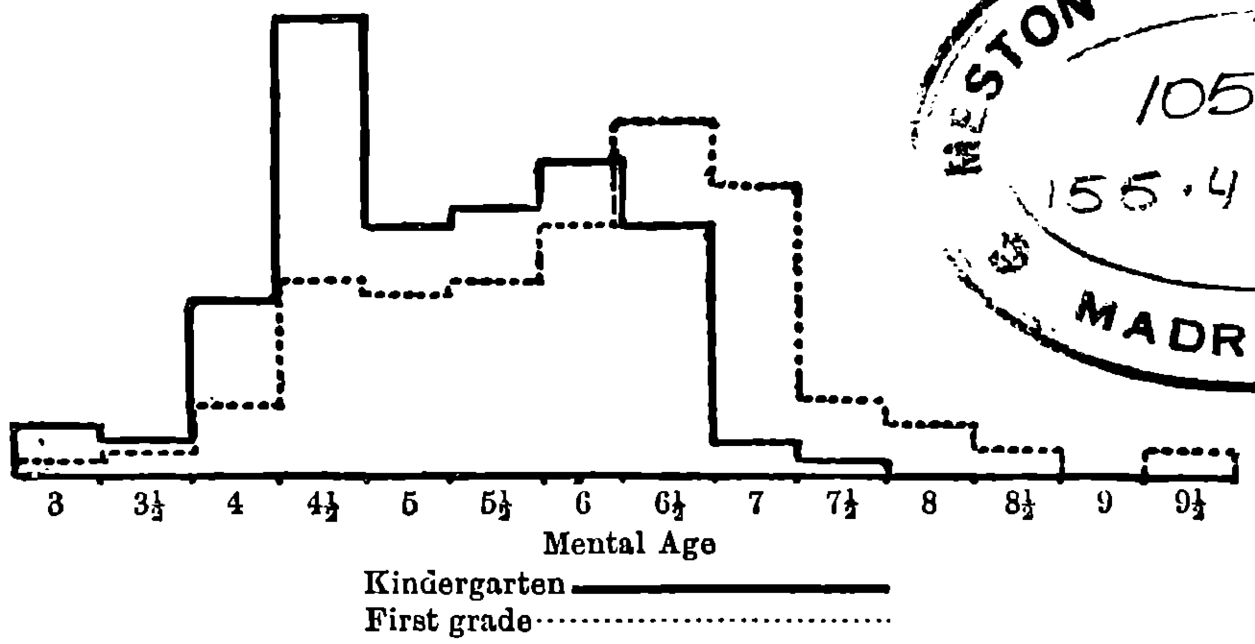

FIG. 11. SHOWING OVERLAPPING OF KINDERGARTEN AND FIRST-GRADE CHILDREN IN MENTAL AGE

Comparison of the mental ages of these 112 kindergarten children with the mental ages of 150 unselected first-grade children tested by Dickson may be made from Figure 11. Nearly a fourth of the kindergarten

children equaled or exceeded the median mental age of those in the first grade, and more than half equaled or exceeded the lowest fourth of first-grade children. A large proportion of these kindergarten children have a mental maturity which would enable them to do satisfactory work in the first grade.

The most abrupt break in the curriculum is that from the kindergarten to the first grade. At all other points every effort is made to bridge the gaps. The transition from first grade to second, from fifth to sixth, etc., is almost imperceptible. Even the first year of high school is rapidly being integrated with the last year of the grammar school so as to give the child an unbroken educational path which he may traverse from the first grade to the university. The kindergarten alone holds aloof, worships at the shrine of a special methodological cult, and treats its children as belonging to a different order of human beings.

The tests of Dickson and Cuneo show how little justification there is for such an attitude. The fact that nearly a fourth of kindergarten children do not differ at all in mental ability from average first-grade children, and that a fourth of first-grade children are on a par with the median kindergarten child, indicates that it would be well for the teachers of these two grades to come to some kind of understanding.

Distribution of intelligence quotients. The I Q's of the 112 children are listed below in order from highest to lowest.

152	114	106	93
146	114	105	93
142	114	103	92
136	113	103	91
130	113	103	91
130	113	102	90
129	113	102	90
126	112	102	90
126	112	102	90
125	111	102	88
124	111	101	86
124	110	101	86
123	110	100	85
122	110	100	85
121	110	100	85
121	109	99	84
121	109	98	82
121	109	98	81
121	109	98	80
120	109	97	80
119	108	97	80
119	108	96	80
118	107	96	79
117	107	96	77
117	107	96	76
114	107	94	75
114	106	94	72
114	106	93	61

The range is from 61 to 152, that is, from feeble-mindedness to very unusual superiority. While only one could be certainly classed as a defective, there are at least three others who are at the borderline of mental deficiency. The lowest 25 per cent fall to 91 or below, the highest 25 per cent reach 117 or above. The median is 106.

Figure 12 shows graphically the number falling in the I Q groups 60–69, 70–79, etc.

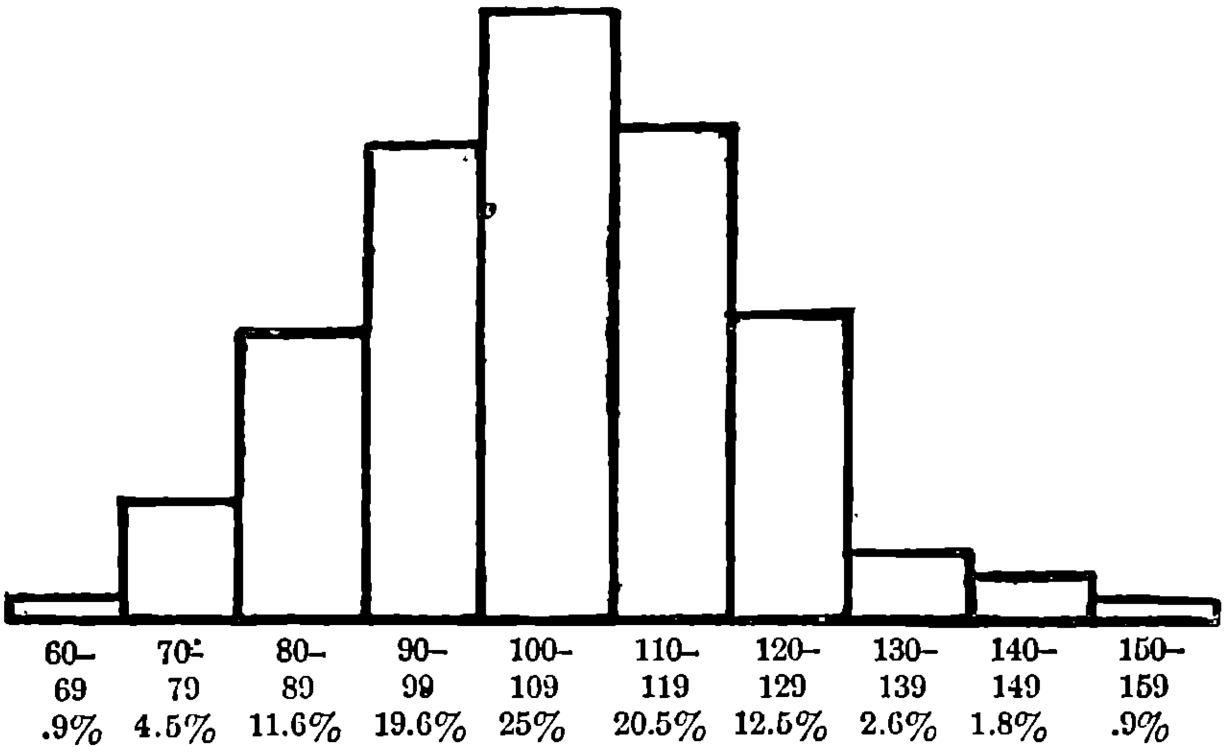

FIG. 12. I Q DISTRIBUTION OF 112 KINDERGARTEN CHILDREN

Sex differences. Is there a sex difference in intelligence at the kindergarten age? We have asked many kindergarten teachers this question and have often received an affirmative answer. The opinion seems to prevail that girls, even at this early age, are somewhat more precocious than boys. Comparison of Miss Cuneo's 65 boys and 47 girls suggests that this opinion may not be without foundation. The medians and upper and lower quartiles were as follows:

	Median	Lower quartile	Upper quartile
Boys......	103	90	114
Girls.	108	96.5	116.5

Although the brightest subject tested was a boy, the median for girls is five points higher than for boys. This is not a large difference, but it is appreciable. It is probable that, age for age, girls are slightly superior to boys in the kind of intellectual ability measured by the usual type of intelligence test. This conclusion is borne out by the results of many other investigations by the test method. It is also in harmony with sex comparisons based on teachers' ratings and school marks. In the present study, 56 of the boys and 47 of the girls were rated for intelligence and 46 of the boys and 36 of the girls for quality of school work. The results were as follows:

Teachers' Ratings on Intelligence

	Inferior and very inferior (per cent)	Average (per cent)	Superior and very superior (per cent)
Boys	17.9	62.5	19.8
Girls	6.4	61.7	31.9

Teachers' Ratings on School Work

	Inferior and very inferior (per cent)	Average (per cent)	Superior and very superior (per cent)
Boys	23.9	58.7	17.4
Girls	8.3	58.3	33.3

Although the superiority of the girls in the tests is very slight, sometimes almost negligible, we have found in something like a dozen separate studies that for a given age or grade the girls invariably make a significantly better showing than boys when rated by their teachers either for intelligence or for quality of school work. We do not attempt to say whether girls make a better use of their intelligence or whether they are more responsive and so appear brighter than they are. Both causes may enter.

Significance of the tests. What do the large individual differences revealed by the tests signify in terms of future educational achievement? Is it possible, as a result of a forty-minute test of a child who is only four or five years old, to forecast with any degree of assurance his educational career? With accuracy, no; in general terms, yes. There is little likelihood that the child who tested at 61 I Q will ever go above median nine-year or ten-year intelligence. On the other hand, the three brightest children in the group, who tested as high as 140, could in all probability be made ready for high school by the age of eleven or twelve years.

Miss Cuneo re-tested seventy-seven of her pupils, as follows:

(1) Twenty-five pupils, interval of two days; (2) twenty-one pupils, interval of half-year; (3) thirty-one pupils, interval of two years. The agreement between the first test and the repeated test was very close

except in a few cases. The median amount of change in I Q was only six points. One fourth of the subjects showed a change of three points or less, and one fourth eight points or more.

Of the thirty-one pupils re-tested after two years, there were four who had earned an I Q of 130 or above in the first test. Two years later all still tested above 130 and all were doing "superior" or "very superior" work in the second grade. Three of them had gained an extra promotion. Of the ten at the other extreme who had earned an I Q of 100 or less, not one had gained an extra promotion.

However, there is a serious source of error to guard against when testing children of this age. Kindergarten children are in the bashful stage and are likely to respond only with silence to tests which they could easily pass. The examiner must, therefore, take care to get into *rapport* with the child if he would avoid the error of mistaking diffidence for lack of intelligence.

Special need of tests in the kindergarten. There is one reason why tests are more necessary in the kindergarten than anywhere else, if the intellectual differences which exist among pupils are to be discovered. In other school grades the work itself constitutes a kind of intelligence test. The first-grade child who cannot learn to read, or the fourth-grade child who cannot learn long division, is readily recognized as inferior. The work of the average kindergarten offers no such clear-cut criterion of intellectual normality.

The games, drawing, sand-pile activities and cardboard construction may disclose certain differences, but these are vague and lack meaning.

This difficulty was reflected in teachers' ratings of the kindergarten children for intelligence. When asked to estimate the intelligence of each child on the usual scale of five: very superior, superior, average, inferior, and very inferior, the teachers protested that there was almost nothing in kindergarten work on which they could base a judgment. The ratings on intelligence were finally secured, but they correlated with I Q's only to the extent of .29. This is not more than half the correlation usually found in the grades above the kindergarten. The correlation of I Q's and the ratings for quality of school work was only .27, and that between mental age and ratings for quality of school work only .43.

Certain disagreements between I Q's and ratings were due to failure to take account of age differences. The 6-year-old is rated "superior" on an I Q about 10 to 20 points lower than a $4\frac{1}{2}$-year-old must have to reach this class. The former gets into the "superior" class as easily with 100 I Q as does the latter with 115 or 120. The following cases illustrate this error:

G. J., age 3–8, mental age 4–2, I Q 113, was rated as "inferior." *M. L.*, also testing at 113, but aged 5–9, was rated "superior."

N. W., age 3–11, mental age 4–3, I Q 109, is rated "inferior." *J. M.*, age 6–11, mental age 6–6, I Q 94, is rated "superior."

M. S., age 4–1, mental age 5–4, I Q 130, is rated "inferior." *J. P.*, age 6–3, mental age 6–10, I Q 109, is rated "very superior."

The kindergarten's demands upon intelligence. The correlation between mental age and quality of work is shown in Table 3.

Mental age	Very inferior	Inferior	Average	Superior	Very superior
7– 4 to 7–10			1	..	..
6–10 to 7– 3			1	1	1
6– 4 to 6– 9		..	9	3	..
5–10 to 6– 3		1	9	5	1
5– 4 to 5– 9		2	3	3	
4–10 to 5– 3		2	13	4	
4– 4 to 4– 9	.	3	5		
3–10 to 4– 3	1	4	5		
3– 4 to 3– 9		1	2		

TABLE 3. CORRELATION BETWEEN MENTAL AGE AND QUALITY OF SCHOOL WORK FOR 80 KINDERGARTEN CHILDREN
(Correlation, .43)

It will be seen that although there is a marked tendency for those of low mental age to do "inferior" work and for those of high mental age to do "superior" work, children of every mental age from $3\frac{1}{2}$ to $7\frac{1}{2}$ are rated as doing "average" work. This can only mean that the activities of the kindergarten do not make very serious demands on general mental ability.

Is this a legitimate ground of criticism of the preprimary curriculum? The answer will depend upon one's philosophy of the kindergarten. There is much to be said for the kindergarten as a combination of

nursery and a place for socialized play. From this point of view its purpose is to serve the life of instinct and emotion, rather than to nourish intelligence. It is a point of view which is attractive, because it has the support of sentiment. Certainly no one would wish to see children of four or five years harnessed to intellectual work to the exclusion of play. This, however, is not the only alternative. Perhaps some of the kindergarten activities could be so adapted as to neglect less than they now do the appeal to intelligence. Possibly a half-hour of the day could be advantageously reserved for work of a somewhat more intellectual character than the hopping, skipping, sand digging or "busy work" of the typical conservative kindergarten, much of which has little to commend it from any point of view. Madame Montessori's injection of more serious activities into the kindergarten would seem to mark a distinct advance.

The contrast between the usual work of the kindergarten and that of the first grade could be justified only on the theory that the child of four or five years is all instinct and emotion, and that suddenly at the age of six or seven he is brought by a sudden metamorphosis into the life of intellect. A comparison of the intelligence tests of kindergarten and first-grade children shows how untenable such a theory is.

But if adjustments are due on the part of the kindergarten, they are perhaps just as much needed in the first grade. The chasm must be bridged from both

sides. The mere fact that a child has passed his sixth birthday is not a sufficient justification for robbing him of all the freedom he has enjoyed in kindergarten and home.

CHAPTER IV

INDIVIDUAL DIFFERENCES IN THE FIRST GRADE[1]

The critical importance of the first grade. The first grade is the most critical in the school system. It is the place above all others where the raw material with which the school is to work should be correctly evaluated. Success or failure for the child's school career hangs often upon his success or failure in the first grade. In a way school administrators appreciate this fact. Effort is usually made to place the best teachers in charge of the entering pupils. School doctors, school nurses, and school dentists are commonly urged to give special attention to the younger children. Nevertheless, it is in the first grade that retardation scores its worst record. *In the average city approximately a fourth of the pupils fail of promotion at the end of the first year.*

Schools for backward children ordinarily do not draw from classes below the third grade. By this time the dull pupil is already a lost cause. Special classes for superior children, when they exist at all, are too likely to confine their efforts to bright pupils whose intellectual progress has already been retarded by several years spent in the educational lockstep. By

[1] Written with the assistance of Virgil E. Dickson.

this time their intellectual ardor has cooled and the edges of their mental faculties have been dulled.

We cannot deny that the task which faces first-grade teachers and supervisors is very difficult. Every twelve months the schools of the United States receive something like three million fresh recruits. What we are urging is the immediate assaying of all this material, year after year. The task is difficult, but we believe it is worth while.

A model study of school grading. The facts which will be presented are from an investigation by Dickson, who has analyzed the results of nearly a thousand Stanford-Binet tests of first-grade children. This account will include the results of the first 150 tests only.

The group included all the pupils found in the first grade in five different schoolrooms in the vicinity of Stanford University. The rooms will be designated by the letters A, B, C, D, and E. Room A included chiefly pupils of Spanish and Italian descent, but American born. Room B represented a mixture of races, with American predominating. Room C was similar to A, but contained a considerable number of Portuguese, in addition to a few Italian and Spanish. Room D drew mainly from the upper and middle social classes of American extraction. The children of Room E were all from an exceptionally well-to-do residential district.

Dickson used the tests only as a point of departure for a more intensive study of the pupils. His purpose

was the practical one of trying to translate individual differences into terms of classroom management. Accordingly, the coöperation of the teachers was enlisted in the collection of a large amount of supplementary data regarding each child, including:

1. Date of entering school;
2. Occupation of the father;
3. Nationality of each parent;
4. The teacher's estimate of the child's intelligence;
5. The teacher's rating of the quality of the school work;
6. The teacher's rating of each child (on a scale of five, as in the case of intelligence and school work) on each of the following twenty-four traits: power to give sustained attention, persistence, social adaptability, leadership, initiative, evenness of temper, emotional self-control, physical self-control, will power, cheerfulness, courage, sense of humor, obedience, conscientiousness, dependability, intellectual modesty, unselfishness, coöperativeness, speed, industry, personal appearance, popularity among fellows, self-expression, accuracy.

Mental-age differences. The ages extended from 5 years 7 months to 11 years, a range of nearly 5½ years. The mental-age range is even greater; namely, from 3 years to practically 11 years. The highest mental age among these first-grade pupils considerably overlaps the lowest we have found in the eighth grade. The number at each mental age is shown in Figure 13.

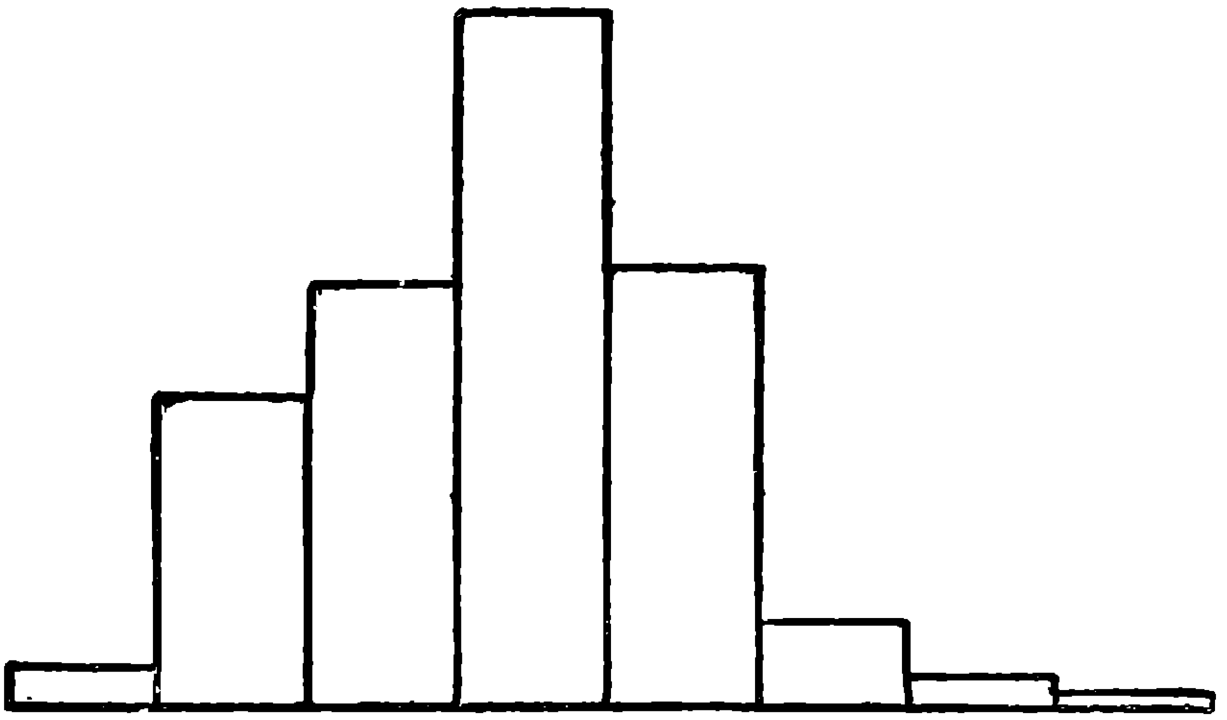

FIG. 13. MENTAL-AGE DISTRIBUTION OF 149 FIRST-GRADE CHILDREN

Mental age necessary for first-grade work. Children are expected to start to school at the age of six years. The assumption is that the degree of mental maturity corresponding to this age is necessary for successful work in the first grade. Is this assumption justified? The question can be answered by a comparison of the quality of school work done by the children of different mental ages. The agreement between mental age and the ratings for quality of work done is shown in Table 4.

It is evident from this table that mental age is a fairly good index of a child's ability to do the work of the first grade. No child below the mental age of 6 years is rated as doing school work above the average, while of the 22 pupils rated as "very inferior" in

Mental Age	Quality of school work					
	5	4	3	2	1	Total
9-6 — up................					3	3
9-0 to 9- 5. ..				..	..	..
8-6 to 8-11........ .		..		1	1	2
8-0 to 8- 5.... ..		1	.	1	2	4
7-6 to 7-11................		.	5	1	..	6
7-0 to 7- 5......		6	10	7	3	26
6-6 to 6-11............		9	18	3		30
6-0 to 6- 5................	..	6	14	1		21
5-6 to 5-11.... ..	3	7	7			17
5-0 to 5- 5................	4	6	4			14
4-6 to 4-11........ ..	8	7	2			17
— to 4- 5....	7	2				9
Total............. ..	22	44	60	14	9	149

TABLE 4. SHOWING HOW QUALITY OF WORK IN THE FIRST GRADE DEPENDS UPON MENTAL AGE. (Correlation .725)

school work, all are below the mental age of 6. The agreement, however, is not perfect. Of the 41 children who are mentally 7 years or above, 7 are rated as doing "inferior" work. All but 2 of these are enrolled in rooms D and E, where the average mental age of the pupils is unusually high. The inference is that teachers have judged these pupils by too high a standard of performance. If placed in room A probably any one of them would rank average or above.

On the other hand, 13 of the 92 pupils below the mental age of 6 years are rated as doing school work of "average" quality. A satisfactory explanation was found in every case. Two of the 13 were repeaters,

one of whom was 10 years old and had been in school over two years. Under the circumstances they would naturally be expected to do average work, even though they are slightly below the mental level of 6 years. The other 11 were all enrolled in classes A and B, in both of which the average mental age was extraordinarily low. In room A, 13 of the 38 pupils were below the mental age of 5½ years, and in Room B 18 out of 39. The 11 pupils whose ratings are in question averaged in mental age 5 years and 10 months. It is therefore not surprising that their school work should have been rated as average in an inferior class.

From such data as the above, collected from all his 1000 cases, Dickson concludes that below the mental age of 6 years the child is not fully ready for the first grade, and that below the mental age of 5½ years the chances that really standard first-grade work will be done are practically negligible. We are beginning to see why a fourth of the pupils in the first grade fail of promotion, for Dickson finds 38 per cent below the mental age of 6 years, and 27 per cent below 5½.

On the other hand, there are in the first grade many pupils of the other extreme of ability who are kept at work which is too easy to command their best efforts. Of the 150 children, 15 (10 per cent) are above the mental age of 7½ years. All of these, and in addition perhaps half of the 26 who tested between 7 and 7½, could quickly be made ready for the second grade. By the present régime these are injured no less than the inferiors.

The influence of age on the ability to do school work. The one condition that the school imposes upon those who would enter is that they shall have passed a given birthday. If the age criterion were adequate we should invariably find the best records in the first grade made by the oldest pupils, and the poorest records by the youngest pupils. The reverse is the case. Of the 39 pupils who were above the chronological age of 7½ years, only 3 were rated above average in quality of school work; of the 10 who had reached the age of 8½ years, none. Conversely, of the 23 who were rated above average in quality of work, 12 were under 6½ years and 20 were under 7½ years, chronologically.

This finding is not new. Every one who has given mental tests to any considerable number of school children has found that the best pupils in a given grade are almost invariably the youngest; the poorest pupils, the oldest. In the present instance this is true, notwithstanding the fact that most of the older pupils are taking the work for the second, third, or fourth time. Some, in fact, had started to school before their youngest classmates were born.

Does age give any advantage whatever apart from the degree of mental maturity which has been attained, or does school success depend entirely upon mental age, except in so far as it is influenced by such extraneous factors as industry, illness, emotional instability, etc.?

Dickson attempted to answer this question by comparing the quality of school work done by older

(dull) pupils and the younger (bright) pupils *of the same mental age.* For the comparison he took two groups of pupils, all of whose mental ages were between 6 and 7 years. The pupils of one of these groups were also chronologically between 6 and 7 years, with I Q's ranging between 96 and 105. The pupils of the other group were between 8 and 9 years chronologically, with I Q's ranging from 72 to 84. The average mental age in the two groups was almost exactly the same. The comparison gave for the older group an average rating of 3.7 in school work; for the younger group, an average rating of 3.12. Since on our five-step scale of rating, 3 means "average" and 2 means "superior," it is seen that there is a difference of more than a half-step *in favor of the younger group.* The significance of this finding is enhanced by the fact that the older group had attended school for an average period of 1.9 years, the younger for an average period of less than one year. The older group has two years the advantage in age, with all the incidental experience which age brings, and in addition the advantage of a year more of school attendance; nevertheless their work is less satisfactory than that of the younger pupils who are at the same level of mental age. We have found this to be the rule in a number of similar comparisons. The additional spontaneity and adaptability of young normal pupils slightly outweigh the advantage of the additional experience and schooling which older pupils of the same mental age have enjoyed.

The distribution of I Q's. The range of I Q's for the 150 pupils is 45 to 145. The median I Q is 88, and it is interesting to note that the brightest child and the dullest child are about equidistant from the median. The lowest 25 per cent fall to 77 or below, the highest 25 per cent reach 124 or above. Figure 14 shows the distribution of intelligence quotients grouped in ranges of ten: 40 to 49, 50 to 59, 60 to 69, etc.

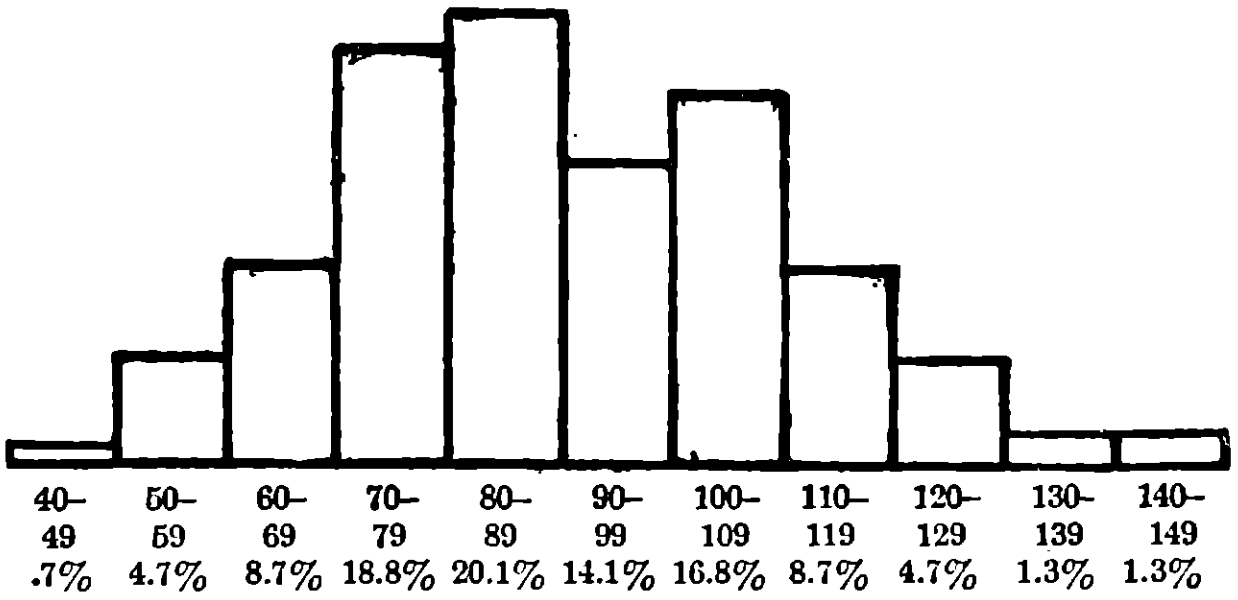

FIG. 14. I Q DISTRIBUTION OF 149 FIRST-GRADE CHILDREN

The low median I Q might be due either to real average inferiority of the pupils tested or to a defect of the scale causing it to yield mental ages too low. That the latter is not the true explanation is indicated by the high average I Q (107) earned by Miss Cuneo's kindergarten children, who were tested on almost exactly the same part of the scale.[1] All the supplementary data

[1] Stanford-Binet tests of more than 2300 children in the kindergarten and primary grades of Council Bluffs, Iowa, yielded an average I Q of 99 points, which is within one point of that which would be expected if the scale were correctly standardized.

confirm the test results in showing that in three of the five rooms, enrolling 107 of the 150 pupils, there was an excessive number of children of low mentality. Had only rooms D and E been examined, the scale would have seemed to err in the direction of too great ease.

Of the 150 children, 21 tested below 70 I Q and 12 below 60. Those below 60 may safely be considered feeble-minded, and probably a majority of those between 60 and 70. Most of the low cases were in two rooms.

It will be recalled that the teachers were asked to estimate the intelligence of each pupil on the scale of 1, 2, 3, 4, 5. The extent to which these estimates agreed with the tests is shown in Table 5.

I Q's	Teachers' estimates of intelligence				
	Very inferior	Inferior	Average	Superior	Very superior
140–149				. .	2
130–139			. .	1	1
120–129		. .	2	3	2
110–119		1	4	8	
100–109		5	20		
90– 99	. .	4	17		
80– 89	4	15	11		
70– 79	8	19	1		
60– 69	3	8	2		
50– 59	5	2			
40– 49	1				

TABLE 5. AGREEMENT BETWEEN THE TESTS AND TEACHERS' ESTIMATES OF INTELLIGENCE. (Correlation .79)

The correlation in Table 5 (.79) is fairly high. By a painstaking analysis of individual cases of disagreement, Dickson was able to show that most of these were caused by the failure of the teachers to take the child's age into account. This is an error which we have found over and over, one from which it seems impossible for teachers to free themselves even when expressly cautioned to do so, as they were in this case. The child of 8 years who has a mental age of 6 years (I Q 75) and is doing almost average work in the first grade, is likely to be rated not far from average in intelligence. The teacher forgets that an average child of 8 years ought to be doing average work in the high-second or low-third grade.

How the five classes differed. These five teachers are expected to accomplish the same work, to turn out a similar product at the end of the year. A comparison of the material with which they are working shows that any such expectation is impossible of realization and unfair to the teachers and to the children. Tables 6 and 7 show how greatly rooms A, B, and C differ from rooms D and E in the mental ages represented.

Room	Median Mental age	Median I Q	Per cent below 5½	Per cent above 7	Per cent repeating
A	6-0	87	.31	.10	.55
B	5-7	76	.46	.05	.35
C	6-0	85	.20	.26	.56
D	7-2	108	.14	.60	.46
E	7-8	112	.00	.71	.07

TABLE 6. SIGNIFICANT DIFFERENCES IN THE MENTAL COMPOSITION OF FIVE FIRST-GRADE CLASSES

I Q's	Room A	Room B	Room C	Room D	Room E
135- up		. .		1	1
130–134		1		. .	1
125–129				1	2
120–124	. .		. .	4	. .
115–119	1	. .	2	3	2
110–114	1	1	.	4	1
105–109	2	.	2	5	1
100–104	5	1	2	2	3
95– 99	4	.	1	2	2
90– 94	3	2	6	. .	1
85– 89	4	3	2	2	
80– 84	6	9	4	. .	
75– 79	6	4	3	2	
70– 74	3	5	4	1	
65– 69	. .	6	2	1	
60– 64	1	3	. .		
Below 60	2	4	2		
Median	87	76	85	108	112

TABLE 7. I Q DISTRIBUTION IN THE FIVE CLASSES

The average mental age in room E is fully two years above that in room B, and the median I Q 36 points higher. The average child of room E excels the average child of room B in brightness as much as an average normal child of 100 I Q excels a feeble-minded child of 66 I Q. Room A has three pupils who grade feeble-minded, room B anywhere from seven to thirteen, room C two to four, room D possibly one, and room E none. Rooms A and C have no pupils who test as high as 120, and room B only one; but 21.5 per cent of the pupils of room D and 28.6 per cent of those in room E grade this high or higher. These differences in

relative endowment are reflected in the number of repeaters found in the five rooms.

A third of the pupils in room A and half of those in room B are incapable of doing standard first-grade work. They are not doing it. The lack of progress on the part of the pupils in room B was so evident that the teacher was in despair and the superintendent doubted her efficiency. But there was nothing wrong with the teacher. Her task was simply impossible. On the other hand, half the pupils of room E have reached a level of mental development which would enable them to do the work of the second grade; three or four of them, the work of the third grade. The lot of this teacher is a happy one. Her pupils are able to learn without instruction.

When a class is so far above or below the average in ability we would expect the teacher to be aware of the fact. That these teachers were only partially so is shown by the distribution of their ratings on school work in the different classes. Although the teacher in room B correctly rates the work of her pupils very low, the teacher of room D rates (incorrectly) more of her pupils below than above average. Plainly her standard is too high, and it is so because the average mental age in her room is above seven years. The teacher of room E complained that six of her fourteen pupils were not doing what she would consider good work. The average mental age in this class was above $7\frac{1}{2}$ years. Dickson estimated that "average" work in

class E was in reality better than "superior" work in any of the other classes.

Sex differences. Of Dickson's 150 subjects, 79 were boys and 71 were girls. Only a small difference was found in the I Q's of the sexes, the girls having the advantage of three points in median. However, as rated by the teachers for quality of school work, the girls made decidedly the better showing. This was true even when the comparison was between boys and girls of the same mental age. Among the 150 pupils were 15 boys and 11 girls who tested between 95 and 105 I Q. The ages, mental ages, and the I Q's of these two groups were almost exactly the same, yet the boys secured an average rating of 3.4 (.4 below "average"); the girls an average rating of 2.81 (.19 above "average"). That is, boys of average intelligence may be expected to do less than average school work, girls of average intelligence to do better than average school work. As stated by Dickson, "It may be that the school curriculum is better adapted to the needs and interests of girls; that girls excel in industry and application; that girls more willingly submit to direction in a task; that girls are better behaved than boys and that school marks are influenced by deportment; that teachers (all women) are better suited to teaching girls than boys; or it may be any one or a combination of many of the causes that might be mentioned."

Racial and social differences. Three of the five rooms (A, B, and C) contained a large element of

Spanish, Portuguese, and Italian children, also a number of North-European parentage. Most of these were born in the United States and all spoke English. The median I Q's were as follows:

Race	Number	Median I Q
Spanish........	37	78
Portuguese.	23	84
Italian............	25	84
North-European...	14	105
American..........	49	106

The children were classified as to social status according to the occupation of the father. The classification was based upon Taussig's division of occupations into five "non-competing" groups: (1) professional; (2) semi-professional or higher business; (3) skilled; (4) semi-skilled; and (5) unskilled. The correlation between I Q and the ratings on social status was found to be .48. The median I Q for classes 4 and 5 taken together was 82.5; for classes 1 and 2 taken together, 112.5. Only one child in class 5 tested above 115, and only one in classes 1 and 2 below 85. Two thirds of these in classes 1 and 2 were above 100, and seven eighths of those in classes 4 and 5 below 100. However, bright children do occur in the lower occupational groups, and when they do they stand out by contrast.

Correlation between intelligence and other traits. It will be recalled that as a part of the supplementary data Dickson had the teachers rate their children on

twenty-four mental and moral traits, in addition to intelligence and school work. The interest in such ratings lies in their bearing on the debated question whether good traits tend to go together or whether superiority in certain lines is likely to be offset by inferiority in others. The latter belief is called "the theory of compensation." It is commonly thought that the possession of a number of undesirable traits is almost certain to be compensated by marked superiority in other traits. Every one knows that this is sometimes true in individual cases. If it were the rule, however, there would be *negative* correlations among some of the traits, and a given individual would show a great deal of unevenness in the ratings received. Such negative correlations were not found. The traits listed below all correlated positively with intelligence and with one another. The correlations with intelligence are shown in Table 8 in order of amount, beginning with the highest.

It is interesting to note that sense of humor, power to give sustained attention, persistence, and initiative all correlate highly with intelligence. They probably depend in large measure upon intelligence. The correlation of social adaptability with intelligence is also high, indicating that there is little truth in the theory that bright children tend to be socially queer or outcasts. The low correlation of obedience, unselfishness, and emotional self-control with intelligence are of interest.

	Trait	Correlation with I Q
1.	Sense of humor	58
2.	Power to give sustained attention	.54
3.	Persistence	.53
4.	Initiative	.53
5.	Accuracy	.52
6.	Will power	.50
7.	Conscientiousness	.48
8.	Social adaptability	.47
9.	Leadership	.44
10.	Personal appearance	.44
11.	Cheerfulness	.43
12.	Coöperation	.43
13.	Physical self-control	.42
14.	Industry	.40
15.	Courage	.39
16.	Dependability	.38
17.	Self-expression (speech)	.37
18.	Intellectual modesty	.34
19.	Obedience	.34
20.	Popularity among fellows	.34
21.	Evenness of temper	.31
22.	Emotional self-control	.29
23.	Unselfishness	.29
24.	Speed	.28

TABLE 8. CORRELATION BETWEEN I Q AND TEACHERS' RATINGS ON VARIOUS MENTAL AND MORAL TRAITS

As a rule, the ratings given an individual child ran fairly uniform through the list of traits.[1] Few children showed numerous oscillations from high to low ratings. Bright children as a rule were rated "superior"

[1] The precaution was taken of having each teacher rate all her children on one trait before taking up the next trait.

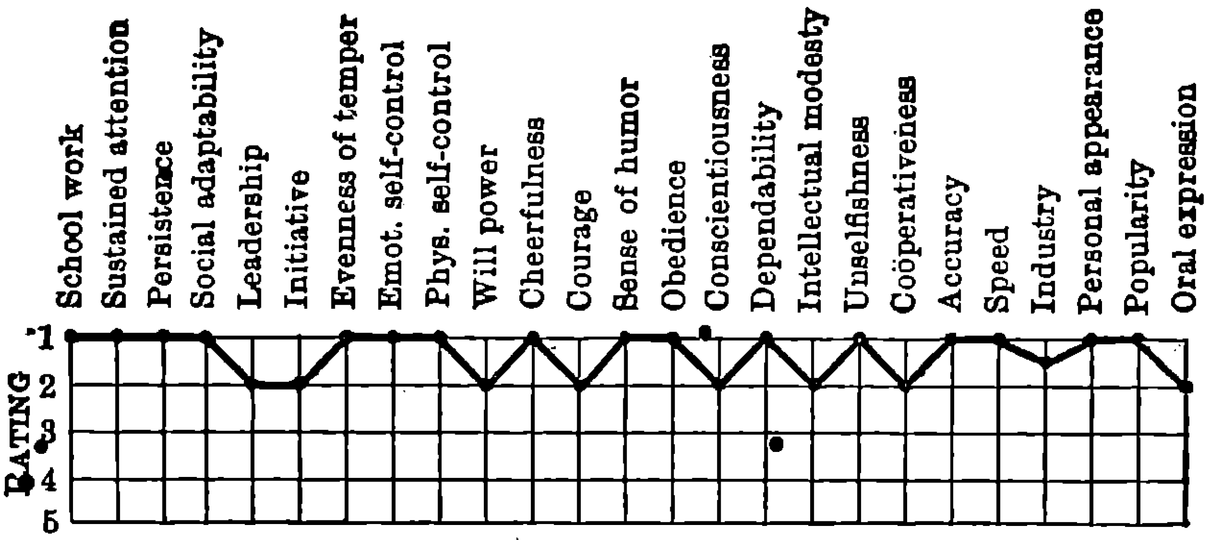

FIG. 15. TYPICAL "TRAIT PROFILE" OF A VERY BRIGHT CHILD. (I Q 133, average rating, 1.34)

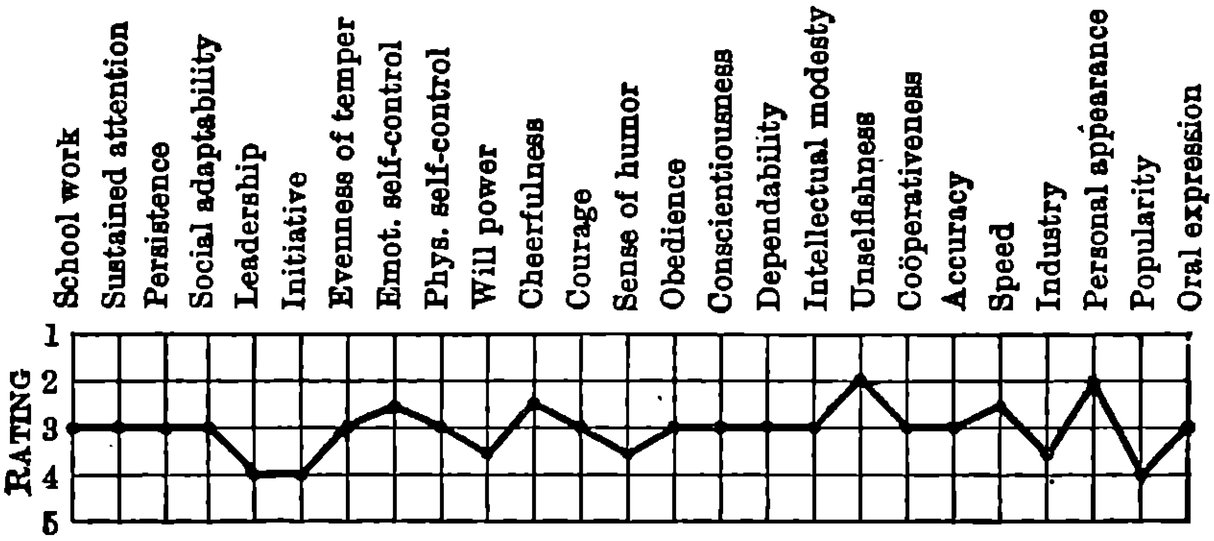

FIG. 16. TYPICAL "TRAIT PROFILE" OF A CHILD OF AVERAGE INTELLIGENCE. (I Q 103, average rating, 3.04)

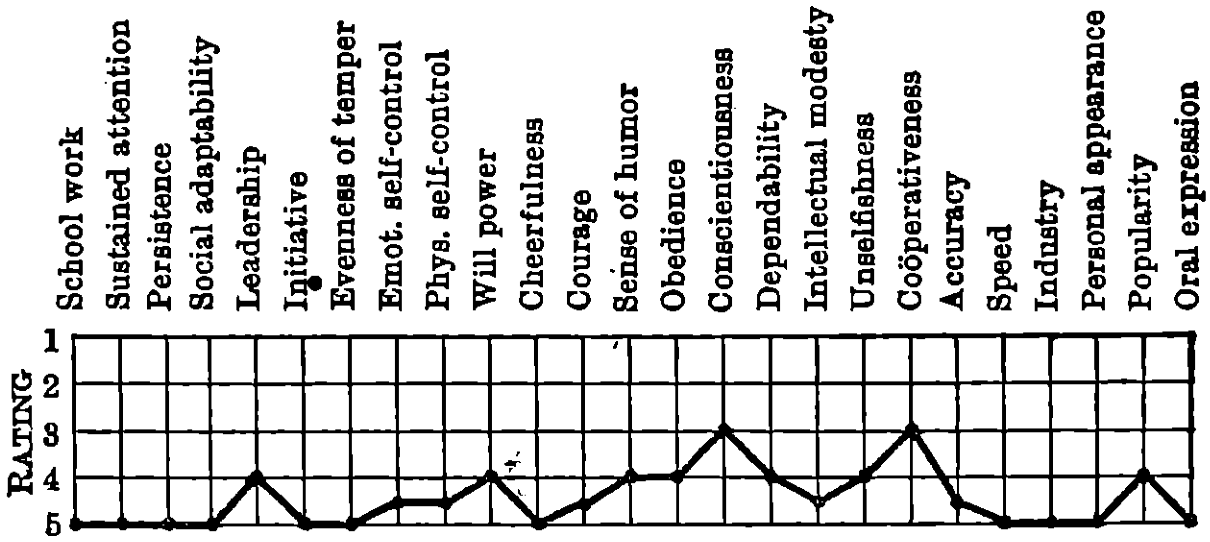

FIG. 17. TYPICAL "TRAIT PROFILE" OF A FEEBLE-MINDED CHILD. (I Q 45, average rating, 4.46)

Average rating on traits	Intelligence quotient																				Total
	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85–89	90–94	95–99	100–104	105–109	110–114	115–119	120–124	125–129	130–134	135–139	140–144	
1.00–1.24.....		..									..	..		..	..	..	1	..	..	1	2
1.25–1.49.....	..							..			..			1	..	..	..	2	.	..	3
1.50–1.74.....			..									..	..	..	1	.	1		..		2
1.75–1.99.....							..	..			..	..	..	1	1	1	..				3
2.00–2.24.....							1	1			1	2	1	1	1	2	1			..	11
2.25–2.49.....								..	..		1	1	..		1						3
2.50–2.74.....	..				..	..		1	1	..	..	1	1								4
2.75–2.99.....	..	..	..	..	1	1	..	3	..	4	1	1	..	..	..	..					11
3.00–3.24.....	..			..	..	3	1	5	3	3	..	2	4	1	1	2					25
3.25–3.49.....	..		..	1	3	4	3	1	4	2	..	2	1	..	..						21
3.50–3.74.....	..		1		1	1	6	4	2	1	3	..		1	1	..					21
3.75–3.99.....	..	..	1	..	2	2	2	2	..	1	1			1							12
4.00–4.24.....	..	2	1	1	1	2	..	.	1	1	..						..				9
4.25–4.49.....	1	1	..		2		1	2									..			..	7
4.50–4.74.....			1								..								..		1
Total.	1	3	4	2	10	13	14	19	11	12	7	9	7	6	6	5	3	2	0	1	

TABLE 9. SHOWING AGREEMENT BETWEEN I Q AND AVERAGE RATING ON TWENTY-FOUR MENTAL, MORAL, AND PERSONAL TRAITS. (Correlation .76)

or "very superior" in nearly all traits, occasionally dropping to average. Very dull children as a rule were rated "inferior" or "very inferior" in nearly all traits, occasionally rising to average. Figures 15, 16, and 17 reproduce from Dickson's report sample "profiles" of one bright, one dull, and one average pupil.

So marked was the correlation between I Q and average rating on the twenty-four traits that knowing only the average of these ratings one could roughly predict what the I Q would be. As shown in Table 9, the correlation is .76. Of the ten pupils with an average rating above 2 (1 being highest and 5 lowest), not one tested below 110 I Q. Of the sixteen with an average as low as 4, none tested as high as 100, and only one as high as 90. Conversely, of the six pupils testing 125 or above, none had an average rating below 2.24; and of the ten pupils testing below 65, none had an average rating as high as 3.24.

Predictions regarding school progress. After the tests had been made and all the supplementary data had been analyzed, Dickson made a prediction regarding each child's probable school progress. Following are samples of these predictions:

Child No. 1. Age 5–10; mental age 6–10; I Q 117; school work 2; low-first grade; in school one-half year. Forecast: Work should continue superior. Should finish fourth grade in three to three and a half years.

Child No. 15. Age 6–4; mental age 5–7; I Q 88; school work 3; low-first grade; in school 1 year. Forecast: Child

is dull and quality of school work will go lower. Present rating of 3 is explained by low average standard in the class. Will probably lose one year before completing fourth grade.

Child No. 21. Age 8–2; mental age 6–8; I Q 81; school work 4; low-first grade; in school 2 years. Forecast: Very dull, and probably will not finish fifth grade by age of fourteen years. Not suited to the regular course of study.

Child No. 35. Age 10–0; mental age 5–1; I Q 51; school work 5; high-first grade; in school 3½ years. Forecast: This child will never reach the fourth grade. Should be placed in an institution for the feeble-minded.

Child No. 122. Age 7–6; mental age 10–11; I Q 145; school work 1; high-first grade; in school ½ year. Forecast: Should be coached on essentials and moved ahead. May be expected to complete the fourth grade within 2½ years after entering school and is capable of doing so in 1½ years.

Child No. 117. Age 7–3, mental age 7–4; I Q 101; school work 4; high-first grade; in school 1 year. Forecast: This boy is average normal, and in an average class would do satisfactory work without repeating. However, as the average I Q of his class is 112, he is likely to lose a half year or more before completing the fourth grade.

It is easy enough to make predictions. How well time will justify them is another question. They will be checked annually as long as the children can be followed. Thus far they have been checked up once, a year after the tests were made. The findings were in the large majority of cases in perfect agreement with the forecast. In a number of cases in which the forecast was not borne out, it could be shown that either: (1) the original supplementary information fur-

nished by the teacher was incorrect (age misstated, etc.); or (2) the teacher had erred in promoting a child who should not have been promoted, or in holding a child back who should have been allowed to go on.

The retarded group. Of the 150 pupils, 33 were retarded, according to the Ayres standard. Dickson examined the data regarding these 33 children with a view to discovering the causes of their retardation. The retarded group was divided into three classes: (1) those showing late entrance; (2) those who entered at normal age but progressed slowly; and (3) children showing both late entrance and slow progress. The facts regarding these three classes are stated by Dickson as follows:

1. Late entrance. "Of the five children who show late entrance, only one has normal mental ability (I Q 99). She has made regular progress since entering school and is now doing work of average quality. The remaining four are subnormal children mentally, belonging either in the feeble-minded or in the border-zone group. The very fact that these four children have a low mental level is the most probable cause of their retardation."

2. Normal entrance, slow progress. "Eighteen children show entrance at normal age, but slow progress. All of these are repeaters, several for the third or fourth time. The mental level of each one is low. Four are probably feeble-minded, the rest would classify in the border-zone or in the dull-normal groups. Only one (I Q 91.7) even approaches the average normal mental level."

3. Both late entrance and slow progress. "Ten children show both late entrance and slow progress. Eight of these have low mentality; one has a mental level approaching the

normal (91 I Q) and is now doing average work; one has a normal level (97 I Q) and the facts at hand do not suggest any cause of retardation."

"*Of the 33 retarded children, only 2 have normal mentality as shown by the tests. Stated in another way, 93.9 per cent of all the retardation in these five rooms is found in children of low mental level. While there may be contributory causes, low mentality is undoubtedly the chief cause of retardation in these five rooms of first-grade children.*"

Feasibility of testing all first-grade children. The first task of the school when it gathers its newcomers together should be to give each child a mental test to determine the nature of his endowment. The test should then be checked up by a large amount of supplementary data and by an annual appraisement of progress.

Granting the desirability of giving every child in the first grade a mental test, is it possible to do so? One is tempted to answer that it is possible because it is necessary. Each teacher may very well test her own pupils, or, if it is preferred, all the testing may be done by a few teachers who have had special training for such work. The latter plan has been followed in Providence, Rhode Island, where during a single school year almost 1000 first-grade pupils were tested by teachers specially detailed for the task. It is reported that the experiment has been a great success; that the tests showed clearly why a third of their pupils were failing of promotion in the first grade. As a result of the experiment the course of study for the

first year was differentiated, and the mentally immature pupils were given work of a pre-primary nature. In the schools of Council Bluffs, Iowa, all the pupils of the kindergarten and primary grades are tested, and entrance to the first grade from the kindergarten is based entirely upon mental age.

CHAPTER V

INDIVIDUAL DIFFERENCES IN THE FIFTH GRADE [1]

HUBBARD investigated the amount of heterogeneity in the classes from the fourth to the eighth grades of the Alameda public schools. The study took into account age, race, sex, social status, achievement as shown by school marks, educational measurements and teachers' ratings on intelligence. Data were secured from approximately 2000 pupils. Such wide ranges of individual differences were found that it was decided to select two classes in the fifth grade for more intensive study by means of the Stanford-Binet tests. The two classes were chosen at random. One enrolled 38, the other 41 pupils.

Extent of differences. The mental ages, ages, and I Q's found in the two classes are shown in Table 10.

The individual differences revealed in Table 10 are enormous and startling. Class A has an age range from 9½ to almost 14 years; class B, from 9½ to almost 15 years. This would not be so serious if all were of approximately equal mental ability. Such equality was conspicuously lacking. The pupils of class A ranged in mental age from less than 10 years to more than 15 years; those of class B, from 7¾ years to 14 years. Two pupils of class A have reached a

[1] Written with the assistance of O. S. Hubbard.

Class A				Class B			
Pupil	Mental age	Age	I Q	Pupil	Mental age	Age	I Q
1	15- 3	11- 8	130	1	14- 0	11- 2	125
2	15- 0	10- 2	148	2	13-10	9- 7	144
3	14- 3	9- 8	147	3	12- 3	11- 5	108
4	14- 0	11- 9	119	4	12- 2	10-10	113
5	13- 8	11- 6	119	5	11-11	10- 2	118
6	13- 7	12- 1	112	6	11- 4	13- 0	87
7	13- 6	10- 7	128	7	11- 2	13- 7	82
8	13- 3	11- 1	120	8	11- 0	10- 6	105
9	13- 2	10- 6	126	9	11- 0	11- 5	96
10	12-11	12- 1	107	10	10-11	14-10	74
11	12- 9	11- 9	109	11	10-10	10- 5	104
12	12- 8	9- 6	133	12	10- 9	11- 9	91
13	12- 6	10- 6	119	13	10- 8	10- 7	100
14	12- 6	10-11	115	14	10- 8	11- 0	97
15	12- 4	10- 9	115	15	10- 8	10- 8	100
16	12- 3	11- 2	110	16	10- 7	13- 3	80
17	12- 3	10- 6	117	17	10- 5	12- 6	83
18	12- 3	13- 5	91	18	10- 4	10- 5	99
19	12- 0	10- 6	115	19	10- 2	10-10	94
20	12- 0	10- 2	118	20	10- 2	10-11	93
21	11-11	11- 8	102	21	10- 2	11- 2	91
22	11-11	10- 8	112	22	10- 2	11- 6	88
23	11-10	12- 1	98	23	10- 1	10- 1	100
24	11- 8	11- 7	101	24	10- 1	10- 4	98
25	11- 4	10- 2	111	25	10- 1	11- 8	86
26	11- 4	10- 7	107	26	10- 0	11- 7	86
27	11- 4	14- 0	81	27	10- 0	11- 0	91
28	11- 3	10- 3	105	28	9-10	10- 5	94
29	11- 2	13-10	81	29	9-10	12- 4	80
30	11- 0	11- 5	96	30	9- 9	10- 8	91
31	11- 0	12- 4	89	31	9- 6	11- 4	84
32	11- 0	12- 4	89	32	9- 4	13- 9	68
33	10-11	11- 8	93	33	9- 3	15- 4	60
34	10- 5	11-11	87	34	9- 0	14- 7	62
35	10- 5	13- 5	78	35	9- 0	10- 2	89
36	10- 4	10- 4	100	36	9- 0	12- 8	71
37	10- 1	10-10	93	37	8- 8	10- 7	82
38	10- 1	10-11	92	38	7- 9	13- 0	60
39	10- 1	12- 0	84				
40	10- 0	11- 3	89				
41	9-11	10- 0	99				

TABLE 10. AGES, MENTAL AGES, AND I Q'S OF PUPILS IN TWO FIFTH-GRADE CLASSES

stage of mental development corresponding to that of the average pupil in the first year of the high school. Either of these pupils could by six months' appropriate training be prepared to do good high-school work. In the normal course of events they will not reach high school for three and a half years. At least two pupils in each class are mentally equal to eighth-grade work. Almost exactly half of the pupils of class A are mentally ripe for promotion to the sixth grade, at least, and one fourth are ready for the seventh grade. Two months of appropriate training would doubtless fit them for such promotion.

On the other hand, class A contains eight pupils and class B fourteen pupils who are at the fourth-grade level of mental development ($9\frac{1}{2}$ to $10\frac{1}{2}$ years); while Class B contains seven who probably belong in the third grade. One of the latter, a pupil of 13 years, has a mental age below 8 and belongs more nearly in the high second grade. Taking the two classes together we find all levels of ability represented from that normal in the second grade to that normal in the first year of high school.

Consider for a moment the contrast between the brightest and dullest pupil in each class. In class A the highest I Q is 148; the lowest, 78. In class B the highest is 144; the lowest, 60. A child in the 140 I Q class should be able to attain marked success in one of the learned professions, but all the refinements of educational method are incapable of bringing a child

of 60 I Q to the level of seventh-grade ability. If both should remain in school the former will be winning Phi Beta Kappa honors at college graduation while the latter is still struggling with simple fractions or long division. The difference between 140 I Q and 60 I Q is 80 points. The difference between an average child and a high-grade idiot, who will never develop beyond three years, is also about 80 points. In the former case, we do not think of the contrast as being so great because our perception of intellectual differences in the upper ranges is much less acute than for the lower ranges. We are on guard against stupidity; we often fail to recognize superiority.

Table 10 shows the usual relationship found between chronological age and mental age in a given grade. Low mental age goes with high chronological age, and low chronological age with high mental age. Expressing it differently, the lowest I Q's are possessed by the oldest pupils, the highest I Q's by the youngest. In class A the third highest mental age belongs to the next to the youngest pupil. In class B the second highest mental age is that of the youngest pupil.

The two classes contrasted. Considered as two groups which are expected to cover the same work in a given time, class A and class B present a striking contrast. In class A, 44 per cent of the I Q's are 110 or above; in class B, only 10 per cent. In class A, 19 per cent of the I Q's are below 90; in class B, 44 per cent. In class A the median I Q is 108, in class B, 91.

The median mental age in class B is slightly over 10 years; that in class A, slightly under 12 years. In other words, the median mental ability of class A corresponds to that normal to the sixth grade; the median of class B to that normal for the fourth grade. Ten per cent of the pupils of class B test below 70; in class A, none. In class B only 10 per cent of the pupils test as high as 110; in class A, 49 per cent. As would be expected, the two classes presented an entirely different picture. The pupils of class A were interested, alert, and above the average in industry; those of class B inert and unresponsive.

From what we know of the significance of the I Q the educational possibilities of these pupils can be predicted with a fair degree of assurance. Approximately 15 or 20 per cent of the pupils of class B will never, with any amount of instruction, be able to do the work of the eighth grade satisfactorily, and 50 per cent are too inferior in endowment ever to complete a four-year course in the average American high school. Of class A, close to 80 per cent should be able to graduate from a high school.

Necessity of an absolute standard of comparison. The teachers of these two classes were not far from equal in ability, training, and devotion to their work. Both were above average. Surely, one would suppose, they must have been keenly aware of the intellectual composition of their classes. They were not, except in the vaguest sort of way. Each teacher knew that

she had some bright and some dull pupils. How bright or how dull was not known. Each teacher could rate her pupils only by comparing them with others in the same class. The teachers' classification of the pupils into the usual five groups, very superior, superior, average, inferior, and very inferior, gave the following results:

	Class A (per cent)	Class B (per cent)
Very superior......	2.6	0.0
Superior...........	15.7	5.2
Average...........	63.1	76.3
Inferior...........	15.7	13.1
Very inferior.....	2.6	5.2

Although the number rated above average is much larger in class A than in class B, as it should be, the number rated below average is exactly the same in the two classes, namely, 18.3 per cent. The teacher of class B did not know that her pupils averaged nearly a year below fifth-grade ability, nor did the teacher of class A know that her pupils averaged a year above. Neither teacher suspected that her class covered a range of four or five years in mental ability. In both classes the significance of over-ageness and under-ageness had been overlooked, for over-age pupils had been consistently rated too high and the under-age pupils too low by each teacher. It had not occurred to the teacher of class B that a high-school education was out of the question for half of her pupils. Even if she had stopped to consider the fact that several of

her pupils were three or four years over-age for the grade, how could she have known that this retardation would not be made up later?

The intelligence tests confirmed by other data. The contrast between the two classes as shown by the intelligence tests is confirmed by the Courtis tests, the Stone Reasoning test, and the Ayres Spelling test. Following are the median scores of each class in these tests and the median scores in the same tests for all the fifth-grade classes of the city taken together.

	Class A	Class B	Entire city
Addition	7.20	3.16	4.98
Subtraction	8.12	2.80	4.81
Multiplication	5.43	1.75	3.56
Division	3.66	0.00	2.63
Reasoning	2.56	1.72	1.73
Spelling	80.	73.75	74.10

In the four fundamentals and in reasoning the average difference between the classes amounts to more than two grades. The difference in spelling is considerably less.

Retardation and acceleration. If we use the Ayres standard and call a pupil retarded who is in the fifth grade and 12 or more years old, then a fourth of the pupils of class A and 29 per cent of the pupils of class B are retarded. This is a rather liberal standard. If we use $11\frac{1}{2}$ years instead of 12 as a basis for figuring retardation in the fifth grade, the amount is increased to 41.5 per cent in class A and to 37 per cent in class B.

The normal mental age in the fifth grade is 11 years. Below 10½ a pupil cannot ordinarily be expected to do satisfactory work. Of the eleven over-age pupils in Class B (i.e., over 12 years of age), only two are as high as 12 years, mentally, and seven are below 10½ mentally. Five are at the third-grade level of mental ability. On the basis of mental age not a single pupil in this class is retarded, but seven are accelerated. Five of these are accelerated fully two years. The median I Q of the eleven over-age pupils is 74.

Of the ten pupils in class A who are over-age (above 12), only three are as much as 12 mentally. Of the remaining seven, five are correctly located according to mental age and two are a full grade accelerated.

Again we see that the chief cause of retardation is not irregular attendance, the use of a foreign language in the home, bad teeth, adenoids, malnutrition, etc., but inferior mental endowment. Educational reform may as well abandon, once for all, the effort to bring all children up to grade.

We have just seen that the over-age pupils were, on the basis of mental age, really accelerated. Turning now to the under-age pupils, we find that these are the real retardates. Class B has one pupil and class A has two pupils who are less than 10 years in chronological age. Their mental ages are 14–3, 13–10, and 12–8. Two of the three are mentally ripe for the eighth grade, the other for the seventh. The "accelerates" are in fact badly retarded. It is always so. We can-

not too often repeat that the retardation problem is exactly the reverse of what it is commonly supposed to be. On the basis of chronological age, class A, with 24.4 per cent of its pupils above 12 years, makes a better showing than class B, with 29 per cent above 12 years. On the basis of mental age, however, 49 per cent of the pupils of class A are retarded, as contrasted with 10.5 per cent of class B.

From the point of view of mental hygiene the conditions in the two classes, while different, are almost equally unsatisfactory. Class A has 49 per cent *above* the standard mental age for the grade; class B has 76.5 per cent *below*. The 49 per cent of class A find the work too easy; most of the 76 per cent of class B have a constant struggle to keep their heads above water. For both conditions, the educational lock-step, with its tendency to promote by the calendar, is responsible. Reform will have to be based upon a consideration of individual differences measured by mental and educational tests.

CHAPTER VI

INDIVIDUAL DIFFERENCES IN THE FIRST YEAR OF HIGH SCHOOL[1]

NOTING that a third or more of the pupils who enter high school do not remain to begin the second year of work, Proctor decided to attack the problem at its most critical point by investigating the abilities of first-year students. The aim of the study was (1) to find how greatly first-year pupils differ in intelligence; (2) to trace the dependence of school success upon intelligence as measured by the tests; (3) to find what relation exists between intelligence and elimination; and (4) to investigate the possible value of intelligence tests in educational and vocational guidance.

All the pupils who entered the Palo Alto, California, High School during the school year 1916–17 were given a Stanford-Binet test. The number in this group was 107. The testing was continued the following year, in part with the Stanford-Binet and in part by the use of a modified form of the Otis Group Scale. Altogether, intelligence measurements were made of approximately 850 first-year pupils in seven different high schools, and of 250 pupils in the eighth grade.

The purpose of the study was not merely to discover individual differences, but also to discover what bear-

[1] Written with the assistance of W. M. Proctor.

ing these have upon educational guidance. It was therefore necessary to check up the test results in as many ways as possible. Supplementary data secured at the time the tests were given included nationality, age, school marks in all the subjects, vocational ambition, occupation of father, and teachers' estimates of intelligence. What was still more important, Proctor followed up the cases over a period of two years, in order to note any changes that might occur in the quality of the school work and to correlate school success with the test results.[1]

As typical of his findings we will present in this chapter some of the results of the Stanford-Binet tests of 137 pupils who had just entered the Palo Alto High School. In every respect the results secured by the Binet tests were closely paralleled by the group measurements of more than 700 additional pupils.

Age differences. The age range was from 13–0 to 19–3, with a median of 14–11. The median age for a thousand unselected pupils entering New York High Schools was 14–5; the median for 1042 in Iowa City, 14–9. While these age differences are of interest, they do not necessarily furnish ground for criticism of school grading. Far from maintaining that children ought to be graded more by age than they are, it is one of the main purposes of this book to show that grading is

[1] The investigation is one of the most serious attempts yet made to analyze the material with which high schools work. Professor Proctor's book should be in the hands of every high-school teacher.

based too much upon age. As will be seen presently, the oldest of these pupils are mentally far below the ability necessary for success in the first year of high school, while the youngest are invariably retarded one or more grades below the level of their mentality.

Mental age differences. In our discussion of mental ages of high-school pupils it is necessary to point out that mental ages secured by the Stanford-Binet above 14 or 15 years have something of an arbitrary meaning. No one knows exactly what median intelligence is for the ages 15, 16, 17, etc., because it is practically impossible to secure unselected subjects above 14 years. By that age the pupils of inferior ability begin to drop out of school. Accordingly, when we speak of the mental age, 16, 17, etc., we are using these figures rather as scores than as mental ages in the literal sense. We simply know that 16 denotes a higher mental level than 15, 17 higher than 16, 18 higher than 17. With this understanding, however, we will continue to employ the term mental age as in preceding chapters.

The mental age scores of the 137 high-school freshmen ranged from 12–8 to 19–6, the latter being the highest possible on the Stanford-Binet. The lowest was earned by a girl whose chronological age was 19–3, the highest by a boy whose chronological age was 13–8. Figure 18 shows the per cent of total number at each mental age.

Only 4 of the 137 pupils were below the mental age

of 13½ years. All of these were over-age ("retarded") pupils. It appears that but for the tendency of teachers to promote on the basis of age, rather than on the

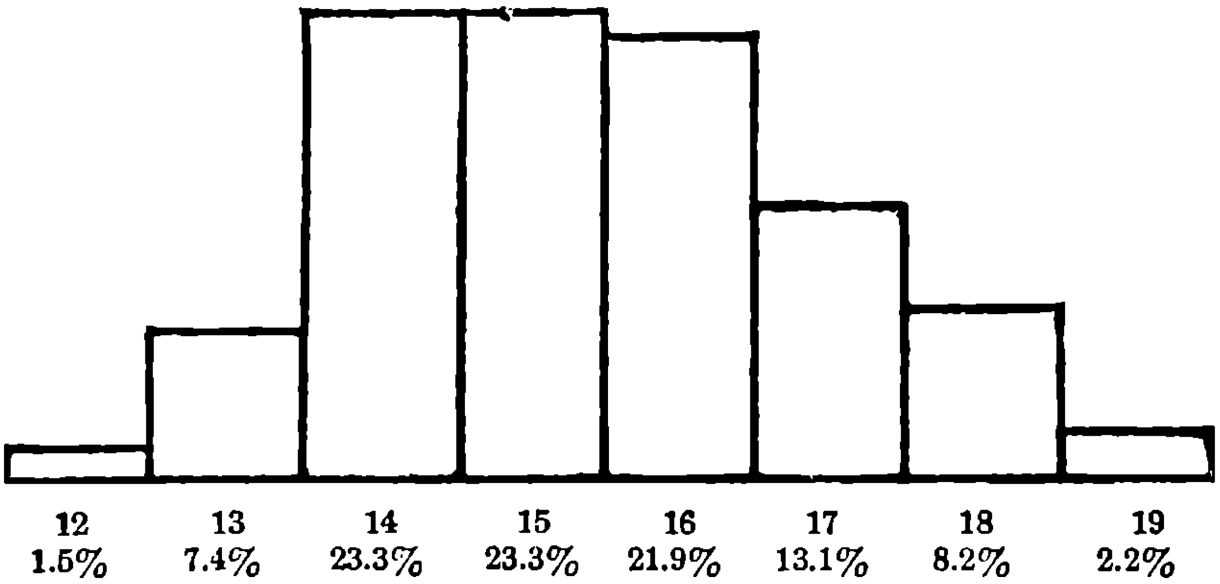

FIG. 18. MENTAL-AGE DISTRIBUTION OF 137 FIRST-YEAR HIGH-SCHOOL PUPILS

basis of ability, there would be few if any pupils in this high school much below the mental level of 14 years. On the other hand, of the 31 pupils who have a mental age score of 17 or above, 26 are less than 15½ years of age. The median mental age of the 137 pupils is 15–10.

The highest mental age in Hubbard's fifth-grade classes (15–3) not only overlaps those of the first-year high school, but almost reaches the median for the latter. However, the lowest mental age in the high-school group (12–8) is not nearly as low as the median for the fifth grade.

If we consider the mental age 14–5 to 15–5 to be that normal for the first year of high school, then 27,

or 20 per cent, are mentally below the standard mental age for the grade, and 80, or 58 per cent, are above. There are 41 pupils, or 30 per cent, above the mental age of 16½; and 22, or 16 per cent, above the mental age of 17½. It could perhaps hardly be maintained that all of these 22 ought to be doing the work of the junior year, as this work is now constituted, but one is tempted to raise the question whether high-school curricula are not framed for a higher level of mental ability than is justifiable.

Mental age and school marks. Is success in high school largely determined by mental age, as was found to be the case in the first and fifth grades? The answer will be found in Table 11, which shows the correlation between mental age and average school mark for the 111 pupils who are still in school.

Average mark	Mental age						
	13½ to 14½	14½ to 15½	15½ to 16½	16½ to 17½	17½ to 18½	18½ to 19½	Total
A		.	.	1	1	3	5
B+	. .	4	4	12	3	5	28
B	4	7	6	8	8	4	37
C	4	10	5	2	1	3	25
C–	4	2	4	4	1		15
D			1				1
Total	12	23	20	27	14	15	

TABLE 11. RELATION BETWEEN SCHOOL MARKS AND MENTAL AGE
(Correlation .45)

The correlation is moderately high, but considerably lower than is found in the grades below the high school. The following facts are, however, very significant:

1. Of the 5 pupils with an average mark of A, not one is below the mental age score of 17 years.

2. Of the 28 whose average score is B +, not one is below the mental age of 15 years.

3. Of the 56 who earned a mental age score as high as 16½ years, only 8 have an average mark below B.

4. Of the 12 with a mental age below 14½, 8 earned an average mark of C or lower.

5. The only pupils tested whose mental ages were below 13½ years (four in number), had already been eliminated because of failure, and so do not appear in Table 10.

Throughout Proctor's study it appears that the standards of work which are maintained in the first year of average California high schools cannot be satisfactorily met by pupils with a Stanford-Binet mental age below 13 years, and that below the mental age of 14 years the chances of success are not good. In rare instances the pupil of 12-year mental age is able to make passing grades, but only by virtue of exceptional application and an attractive personality.

Intelligence quotients. For the group of 107 pupils entering in September, 1916, the I Q's ranged from 79 to 136, with a median of 105. The lowest 25 per cent fell to 96 or below, the highest 25 per cent reached 117 or above. The median for the boys was 107; for the girls, 102.

The distribution of I Q's is shown in Figure 19. The most striking thing about the distribution is that only three cases appear below 85, and only eight cases below 90. Above 90 the number of cases increases with marked suddenness, indicating that entrance to this high school is pretty well barred to children who test much below 90.

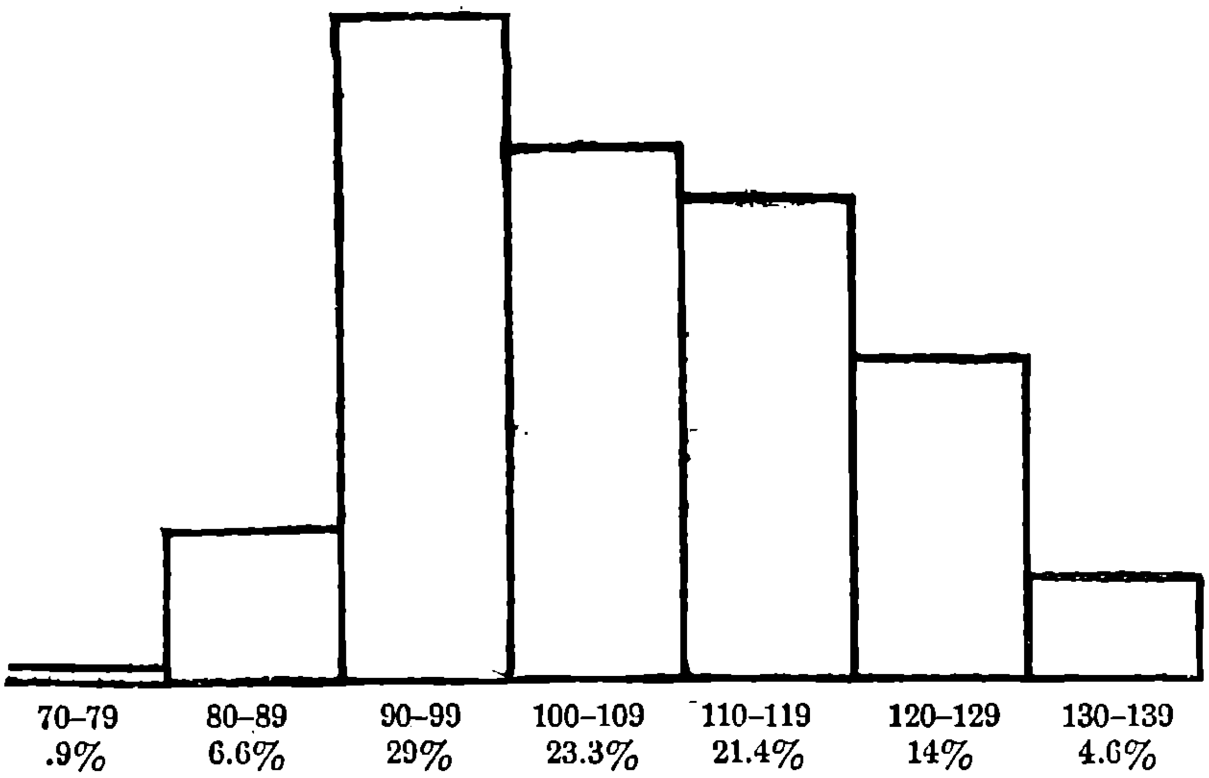

FIG. 19. I Q DISTRIBUTION OF FIRST-YEAR HIGH-SCHOOL PUPILS

Except for the smaller number in the lower range, the distribution of I Q's of first-year high-school pupils is similar in form to that found for the lower grades. However, the Stanford-Binet probably grades a trifle severely at the upper end. As is shown elsewhere an I Q of 130 in the case of a child of 15 years is probably equivalent to an I Q of 140 for a child under 12. Even so, the range of I Q's from 79 to 138 is very great.

I Q and chronological age. There was found, as would naturally be expected, a high negative correlation (–.74) between I Q and chronological age, which, of course, simply means that the children who enter high school young are generally brighter than those who enter late.

I Q	Chronological age						
	13	14	15	16	17	18	19
130–139	2	2	1				
120–129	2	8	5	.	. .		
110–119		14	7	1	1		
100–109		2	14	8	1	. .	
90– 99			11	16	3	1	.
80– 89			1	2	2	1	1
70– 79							1

TABLE 12. SHOWING NEGATIVE CORRELATION BETWEEN AGE AND I Q. (Correlation —.72)

As shown in Table 12, no pupil below 13½ years tested lower than 120. Of the 30 pupils below 14½ years of age, not one tested lower than 100, and only 2 lower than 110. It is evident that to enter this high school on schedule time ordinarily requires decidedly better than average intelligence. On the other hand, of the 38 pupils who were above the age of 15½, only 11 tested as high as 100, and only 2 as high as 110. These 38 pupils constitute the retarded group, again indicating that the chief cause of retardation is mental inferiority. Of the 38, 70 per cent are below 100 I Q. As

we have already stated, the lowest I Q was that of a girl who was over 19.

The negative correlation between age and brightness is further illustrated by the scores made in the vocabulary test. Table 13 shows that in general the largest vocabularies are possessed by the youngest pupils, the smallest vocabularies by the oldest pupils. The positive correlation of vocabulary with mental age is shown in Table 14 for comparison.

Vocabulary score	Chronological age						
	13	14	15	16	17	18	19
90–99	1	..	..				
80–89	.	1	1	..	.		
70–79	1	5	11	3	1		
60–69	4	21	10	12	2	..	
50–59		9	21	13	4	1	
40–49		2	6	2	3	1	..
30–39							2

TABLE 13. VOCABULARY AND AGE. (Correlation —.40)

Vocabulary score	Mental age						
	13	14	15	16	17	18	19
90–99						.	1
80–89			..	..	..	1	1
70–79		..	1	6	4	6	4
60–69	.	3	10	18	10	6	2
50–59	2	10	17	13	5	1	
40–49	1	9	2	2			
30–39	1	1					

TABLE 14. VOCABULARY AND MENTAL AGE. (Correlation +.656)

I Q and school work. The correlation between I Q and school work was somewhat higher than between mental age and school work (.545 as against .44). While the disagreements were fairly numerous, most of them could be accounted for by such factors as health, attendance, degree of application, and attitude toward work. Often it was the test which disagreed most with quality of school work that contributed most to an understanding of the pupil. In general, however, school work rose and fell with I Q, as is shown by Tables 15 and 16.

School marks	Average I Q	No. cases
50–59	85	12
60–69	100	16
70–79	107	56
80–89	110	24
90–99	123	4

Table 15. Average I Q for Different School Marks

I Q	Average mark	No. cases
75– 84	63	2
85– 94	72	17
95–104	74	28
105–114	76	24
115–124	81	19
125 and over	83	12

Table 16. Average School Mark for Different I Q's

I Q and teachers' estimates of intelligence. The teachers were asked to estimate the intelligence of each pupil on the usual scale of 1, 2, 3, 4, 5. For 102

pupils the ratings were made by at least three teachers. The ratings for each child were then averaged to secure a composite rating. The teachers did not confer with one another in making the ratings nor did they know the results of the tests. The correlation of the composite ratings with I Q's is shown in Table 17.

Composite ratings by teachers	Intelligence Quotient						
	75–84	85–94	95–104	105–114	115–124	125–134	135+
1 to 1.74		..	..	..	4	3	..
1.75 to 2.49		1	3	8	7	4	1
2.5 to 3.24		7	12	12	6	4	
3.25 to 3.99	..	6	13	4	2		
4 to 4.75	2	3	1				

TABLE 17. SHOWING AGREEMENT BETWEEN I Q AND TEACHERS' RATINGS ON INTELLIGENCE. (Correlation .59)

The correlation is fairly high. It would have been considerably higher but for the fact that the over-age children were rated too high, the under-age children too low. The tendency of teachers is to base their estimates of intelligence on the quality of the work, paying too little attention to age or degree of application. The correlation between the teachers' ratings and the class marks was .70. There were eight pupils below 95 I Q who received an intelligence rating of "average." All but two of these were above the median chronological age of the class.

Although the teachers' ratings were made independ-

ently of each other, there proved to be an average inter-correlation of .677 between the ratings of one teacher and those of another. This would indicate that all the teachers based their estimates of intelligence on much the same thing, namely, quality of school work.

Relation of intelligence to elimination. Of the 107 who entered the Palo Alto High School in 1916–17, all of whom were tested, there were 27 who did not reënter the following year. Fourteen of these had transferred to other schools and 13 had left school "to go to work." The I Q's of the latter group were 79, 83, 85, 87, 90, 92, 97, 97, 101, 105, 106, 115. The boy with I Q of 115 had left only temporarily on account of family finances. Ten of the 13 were below the median I Q for the class (105). The average I Q of the 14 who transferred to other schools was 110. The average of the 13 who dropped out was 94. Seven of the 13 had received marks denoting failure in more than half their school work. Plainly most of these pupils did not really "quit school to go to work"; they went to work out of school because they could not do the work in school.

Had there been a better understanding of the degree of mental ability necessary for success in certain studies fewer eliminations would have resulted. In this high school, at least, the pupil with I Q below 90 is practically certain to fail in such studies as algebra and Latin. For purposes of educational guidance it will be necessary to establish the lower limits of intel-

lectuality necessary for success in the various high-school subjects.

Other evidence that elimination is selective. In the average American city not more than 40 per cent of the pupils who enter the first grade remain to enter high school, and ordinarily not more than 10 per cent graduate from the high school. Smaller cities make somewhat better records, but it is an exceptional school system that graduates from the high school as many as one fifth of its children. In the case of the 318 cities of all sizes studied by Strayer, the central tendency was for about 37 per cent to enter the first year of high school, 25 per cent to enter the second year, 17 per cent the third year, and 14 per cent the fourth year.[1] The 58 cities studied by Ayres and the 23 studied by Thorndike made a considerably lower record, particularly in the third and fourth high-school grades. It is not uncommon for one third to drop out without completing the work of the first year. Not all of this elimination is traceable to inferior mental ability, but that a large part is due to this cause there is no longer room for doubt.

Van Denburg studied the school records of 1000 representative children who entered the first year of high school in New York City. That these 1000 pupils represented a rather highly selected group is shown by the fact that although only one pupil in twenty-three

[1] Strayer, G. D., *Age and Grade Census of Schools and Colleges.* Bull. No. 451, U.S. Bureau of Education, p. 6.

in the elementary schools of New York gained special promotion, one third of those who entered high school had done so. We have already seen that pupils who enter high school considerably retarded are almost invariably pupils of inferior ability, and that those who enter under-age are exceptionally bright. Remembering this, it is interesting to note that Van Denburg found that pupils who enter late are very much less likely to graduate than those who enter young. The same result was found for Iowa City over a period of ten years.[1] Table 18 shows the "graduation expectancy" of pupils who enter at various ages.

Age of entrance	Iowa City (per cent)	New York (per cent)
12–13	65	23
13–14	50	19
14–15	39	10
15–16	29	6.5
16–17	17	3.5

TABLE 18. GRADUATION EXPECTANCY OF PUPILS ENTERING HIGH SCHOOL AT VARIOUS AGES

Even when the late entrant remains to graduate he normally requires more than four years to do so. For example, King found that only 13 per cent of those entering at 16 graduated in four years, and only 9 per cent of those entering at 17.

Van Denburg's 1000 pupils were rated by their teachers on ability shortly after they entered upon the

[1] King, Irving, *The High School Age* (Dodd, Mead & Co., 1914), p. 196.

first semester's work. Three grades were used: "high," "average," and "low." Of those rated "low" 50 per cent dropped out in one half year or less; of those rated "average," 50 per cent dropped out within one and one half years; of those rated "high," 50 per cent remained for three years or more. The marks given these pupils at the end of the first term proved also to have great value as an index of future elimination. The median expectancy for those securing various marks was as follows:

Average of 1st term's marks (per cent)	Time during which 50 per cent remained in school
0– 49	½ year
50– 59	1 "
60– 69	1½ years
70– 79	2½ "
80–100	4

There can be but one conclusion from facts like those we have just cited: *high-school elimination is very selective.* Although there are many individual exceptions, the pupils who drop out are in the main pupils of inferior ability. The high school offers little which can be done by pupils of much less than average intelligence.

Are high-school standards too high? It would seem that if the pupils of inferior ability are to be retained the high school will have to do one of two things: either (1) lower the standards in the present courses, or (2) add other studies which are easier while at the same time educationally worth while.

It may be that we have judged the high school too exclusively by the difficulty pupils encounter in meeting its standards for graduation. Largely through the influence of the university, the bars have been raised until graduation is well beyond the intellectual endowment of a large proportion of children. Below 90 I Q graduation is by no means likely, and nearly a third of all children test this low or lower. Proctor found that 70 per cent of those testing below 95 I Q failed in more than half of their studies. A nation falls short of the true ideals of democracy which refuses to furnish suitable training to a third of its children merely because their endowment does not enable them to complete a course of study which will satisfy the requirements for college entrance.

There was a time when those whose ability would not carry them through algebra or Latin could turn with some hope of success to the modern languages or to science. In proportion as these studies became established they too raised their requirements. When the commercial subjects were brought into the high-school curriculum, these in turn became the dumping-ground for failures. However, the teachers of commercial subjects were not long in discovering that there is no demand in stenography or bookkeeping for commercial graduates of inferior ability. At present other lines of vocational training are being introduced into the high school and the pupils who cannot succeed in the older subjects are turning to these. Whether

the solution will be found there will depend largely on the variety of courses the high school undertakes to offer, and on whether it is willing to forego the semi-collegiate standards in favor of a humbler task.

High schools at present are in a measure "class" schools. The child of 75 to 85 I Q has an inalienable right to the kind of training from which he can derive profit. Since there are so many who cannot master the usual high-school studies, new lines of work of a more practical nature will have to be added. Since there are probably ten per cent who have not even the ability to complete the work preparatory to high school, the differentiation of courses will have to begin in the sixth or seventh grade. Instead of being undemocratic, as some have argued, such differentiation of courses and enlargement of opportunities for vocational training of the humbler sort is a necessary corollary of the truly democratic ideal.

CHAPTER VII

THE MENTAL-AGE STANDARD FOR GRADING [1]

The I Q does not itself tell us in what grade a pupil belongs. A child testing at 75 I Q and another testing at 125 may be equally ready for work of fourth-grade difficulty, provided the chronological age of the former is thirteen and that of the latter eight. Each would thus have a mental age of approximately ten years. The basis of grading is therefore mental age rather than I Q. The latter is merely an index of brightness. It is extremely significant, because it enables us to forecast a child's later mental development, but grade of work which a pupil can do at any given time depends rather upon the absolute mental level.

There is a slight correction to add to this statement. To a certain extent I Q differences do affect the quality of school work which a given mental age may do. In the illustration given above, it is altogether likely that the eight-year child of 125 I Q will do somewhat better work in the fourth grade than the thirteen-year child of 75 I Q, even though they have the same mental age. The greater intellectual spontaneity of the young bright child somewhat outweighs the advantage which the older but mentally inferior child has in age and school training.

[1] Written with the assistance of Isabel Preston.

Normal mental age for the different grades. The child is expected to start to school between the ages of six and seven years. Although many start later and some younger, the average entrance age in most parts of the United States is not far from six and a half. Reckoning on this basis the standard mental age for the different grades would be as follows:

Grade	Standard mental age		
I	6–6 to 7–5	or approximately	7 years
II	7–6 to 8–5	" "	8 "
III	8–6 to 9–5	"	9
IV	9–6 to 10–5	"	10
V	10–6 to 11–5	"	11
VI	11–6 to 12–5	"	12
VII	12–6 to 13–5	"	13
VIII	13–6 to 14–5	"	14
High School I	14–6 to 15–5	"	15
Etc.			

Children who are in grades corresponding to these standards are in the large majority of cases found doing work of average quality. If the mental age is much above or below the norms just indicated the school work is usually correspondingly superior or inferior.

Table 19 shows the per cent of children rated as superior, average, or inferior *who are in the grade corresponding to mental age* (1936 cases).

It is seen that the mental age norms we have given fit the difficulty of work in the different grades fairly closely. There is a slight tendency, however, for chil-

Mental age	Grade	Quality of work		
		Inferior or very inferior (per cent)	Average (per cent)	Superior or very superior (per cent)
6-6 to 7-5	I	20	52	28
7-6 to 8-5	II	26	46	28
8-6 to 9-5	III	23	57	20
9-6 to 10-5	IV	25	54	21
10-6 to 11-5	V	24	58	18
11-6 to 12-5	VI	31	49	20
12-6 to 13-5	VII	28	50	22
13-6 to 14-5	VIII	31	48	21
14-6 to 15-5	H.S. I	47	34	19

TABLE 19. SHOWING QUALITY OF SCHOOL WORK DONE BY CHILDREN WHO ARE IN A GRADE CORRESPONDING TO MENTAL AGE

dren of the mental age 6-6 to 7-5 to do better than average work in grade I, and for those of mental age 13-6 to 14-5 to do below average work in grade VIII. This is what should be expected, since the average mental and chronological ages for grade I are a little below seven years, and those of grade VIII a little above fourteen years. In the first year of high school the child of standard mental age finds it still more difficult to do average work. The median mental ages actually found in the eight grades and the first year of high school are as follows:

Grade	I	II	III	IV	V	VI	VII	VIII	H.S I.
Cases tested	341	189	181	253	226	236	193	180	137
Median mental age	6-10	7-11	9-0	9-11	11-0	12-1	13-1	14-2	15-4

So far, we have shown that the child of standard mental age for a given grade tends to do average work in that grade. It remains to show that if the mental age is above or below the standard, the school work tends to be superior or inferior to the average.

Of the 1936 children appearing in the above table, 120 were two or more years above the grade normal to their mental age. This is 6.2 per cent of the entire number. Of the 120 not one was rated as doing superior work, and only 19 as doing average work. The remaining 101 were rated as doing work of inferior or very inferior quality. Of the 1936 there were 234 who were located in a grade two or more years below the standard for their mental age. Of these, 52 per cent were rated above average in school work, 33 per cent average, and 15 per cent below average.

Summarizing, we can say that while children located in a grade two years above mental age are rarely able to do average work, there are somewhat more in a grade two years below mental age whose school work is not satisfactory. The child with mental age more than equal to his work may yet fail because of illness, lack of application, or for any of a number of reasons. On the other hand, exceptional industry can rarely make good the disadvantage which a child suffers whose mental age is two or three years below the grade standard.

Sources of error in judging school success. The agreement of school performance with mental age

standards would doubtless have been closer if all the teachers who rated their children had been infallible judges of the quality of school work, if the work of a given grade had always been of the same difficulty, and if they all had taken the terms "average," "superior," and "inferior" in exactly the same sense. All of these sources of error are serious, especially the last. As we have pointed out so many times, each teacher tends to take as her rating standard the average work actually being done in her class. If her class has a disproportionate number of dull pupils she tends to rate too high; the reverse, if her class as a whole is exceptionally bright.

Ratings on school work are also likely to be influenced by the personal traits of the individual children. Traits which tend to cause over-rating are vivacity, responsiveness, talkativeness, self-confidence, good looks, neatness, application, and conscientiousness. The child who is vivacious and self-confident, but parrot-like and superficial, is almost sure to be over-rated; the stolid-appearing or quiet and timid child, to be under-rated. The child who does his work neatly and conscientiously is likely to be rated more leniently than the child who is slovenly, careless, or disobedient. The child whose hearing or speech is defective is also at a disadvantage in such comparative ratings.

Errors of this kind, however, are not sufficient to account for the fact that only forty to sixty per cent

of school pupils are located in the grade corresponding to mental age. Perhaps an even more frequent cause of incorrect grading is the tendency of teachers to promote children by age, resulting in over-promotion of the dull and under-promotion of the bright. The teacher does not ordinarily realize how far the dull over-age child has been promoted beyond the grade where he could do average work. She is still farther from knowing that the typical under-age bright child would in a majority of cases continue to do satisfactory work if promoted one or two grades.

However, there are occasional discrepancies between mental age and school performance which cannot be traced either to errors in rating or to mechanical methods of promotion. The quality of a child's school work depends in part upon other factors than intelligence, among which are health, regularity of attendance, degree of application, attitude toward teacher, emotional stability, amount of encouragement at home, etc. The effect of most of these extraneous factors is to make school performance less satisfactory than the mental age would lead us to expect.

Discrepancies between mental age and school performance. For several years, in connection with Binet tests made by many Stanford University students, we have investigated those cases in which a marked disagreement was found between mental age and school performance. The findings would fill a long and interesting chapter, but the results of a single series of

tests will acquaint the reader with the common types of cases. We will select for this purpose the investigation of Miss Preston, who made a study of the disagreements found in tests of 238 pupils in the eight grades of the Santa Clara, California, grammar school. The pupils tested constituted about a third of those enrolled in the school, and were selected so as to be as nearly as possible representative. Most of them had also been given the Trabue B and C Completion Tests and the Army mental test. In addition each child was rated by the class teacher on each of the following: social status, school work, intelligence, dependability, and social adaptability. Miss Preston had been for ten years principal of the school in which the tests were made, and had known all the children personally from the time they first entered. Her acquaintance with parents and home conditions was also of great advantage.

It was found that in the great majority of cases the result of the Stanford-Binet test agreed remarkably well with the child's school work, particularly when the quality of work for a period of years was made the basis of the comparison. The 238 tests yielded only 34 discrepancies worthy of note, and many of these were not large. In 29 of the 34 cases the quality of school work as rated by the teacher was poorer than the mental age would seem to warrant, and in only 5 cases better. Where discrepancy of the latter kind occurred it was ordinarily due either to ex-

ceptional application on the part of the child or to the effect of vivacity, responsiveness, or other favorable personal traits in influencing the teacher's judgment. On the other hand, discrepancy in the direction of inferior work resulted from a variety of causes, including timidity, lack of self-confidence, physical defects, lack of application, emotional instability, psychopathic heredity, home "spoiling," love affairs, etc.

In the following pages we present Miss Preston's brief description of the salient features of typical cases of discrepancy. The ratings given by the teacher were in this experiment based on a scale of seven,[1] as follows:

1. "Very superior";
2. "Superior";
3. "Above average";
4. "Average";
5. "Below average";
6. "Inferior";
7. "Very inferior."

Showing effect of unusual application.

Ernest. Age 15–0, mental age 12–3, I Q 82, eighth grade, quality of work 5. Portuguese, social status 5. Teacher's ratings: intelligence 5, social adaptability 3, dependability 3.

Discrepancy: The mental age is a year and a half below that normal for the eighth grade, but the work is passing (though below average).

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[1] It will be necessary to bear in mind that the numbers designating ratings do not correspond to those quoted in other chapters of this book, most of which were based on a five-fold instead of a seven-fold classification.

Ernest's teachers agree that the test has rated his intellectual ability correctly. It happens, however, that his most characteristic trait is one which escapes an intelligence scale. Ernest is an erect little fellow, with a straightforward look, who works with all his might at anything he attempts to do. No other pupil in the school equals him in application. He often reaches school ten minutes after seven o'clock in order to study his history lesson until nine. First he reads and re-reads his lesson in an attempt to get the meaning. Then he writes it. After that he says it aloud over and over. When the other children begin to arrive he hauls one of them in to hear him recite it and to have him explain what some of the words mean. In class, Ernest is a living question mark. "What does it mean by those words?" "Does it mean this?" He is oblivious to the teacher's impatience and to the amusement caused among his fellow pupils. There is no escape from his questions. Even as the line files in or out his teacher gets a "What does this mean?" as he marches by. When Ernest does a thing he does it thoroughly, in school or out. He is captain of the baseball team and does a vigorous job of it.

Showing effect of child's personality on the teacher's ratings.

Jennie. Age 12, mental age 10–8, I Q 89, sixth grade, quality of work 2. American, social status 3. Teacher's ratings: intelligence 2, social adaptability 2, dependability 2.

Discrepancy: "Superior" work in a grade which is more than a year above her mental age.

Jennie attracts attention by her smiling, vivacious face and sparkling eyes. She is alert, quick in movement, but without self-consciousness. In conversation she is responsive, eager and reflects your every expression. In class her eye never leaves the teacher's face and she follows every explanation with intent eagerness. All of this naturally influ-

ences the teacher's estimate of her intelligence and school work.

Donald. Age 12–0, mental age 16–8, I Q 139, sixth grade, quality of work 2. American, social status 3. Teacher's ratings: intelligence 2, social adaptability 2, dependability 2.

Discrepancy: The mental age would indicate ability to do high school work, but Donald is only in the sixth grade. However, his work in this grade is "superior" and it is probable that he would be able to do satisfactory work in a higher grade.

Donald is chiefly of interest in comparison with Jennie, described above. The two are of almost exactly the same age and are both doing "superior" work in the sixth grade. Jennie, however, is barely average-normal in intelligence, while Donald tests at 139. This difference is confirmed by the Trabue test and also by the Army test.

In personality Donald presents a striking contrast to Jennie. Her responsiveness and vivacity are fully matched by his apparent stolidity and shyness. Donald talks only in monosyllables. He has been so thoroughly suppressed at home by a severe father that he is shrinking and timid. When successful in drawing him out one finds a highly sensitive nature of rare sweetness and poetic feeling. But the least stir sends him shrinking back into his shell with a hurt air and a suspicious glance. He has no self-confidence, never expresses his feelings, and avoids doing anything that could possibly attract attention.

Claire. Age 9–10, mental age 12–7, I Q 128, fourth grade, quality of work 2. American, social status 4. Teacher's ratings: intelligence 2, social adaptability 2, dependability 1.

Discrepancy: Mental age two years above her grade. However, her school work is superior and she could probably do the work in the next higher grade. The fact that

she has had one extra promotion agrees with her high intelligence quotient.

Claire is slow in her movements and slow in finishing assigned tasks. She is diffident, hesitating in speech, and waits for approval. Her teacher seldom realizes, until review time, how thoroughly Claire gets her work.

Showing effect of timidity and lack of self-confidence.

Clifford. Age 8–5, mental age 8–6, I Q 101, third grade, quality of work 5. American, social status 4. Teacher's ratings: intelligence 4, social adaptability 4, dependability 4.

Discrepancy: In grade corresponding to mental age, but his work until last year barely passing.

Clifford has no self-confidence. His mother speaks in his presence of his stupidity and compares him disparagingly with his bright older brother. Hard to get him to try, but his work has recently shown improvement.

Louise. Age 9–1, mental age 10–6, I Q 115, fourth grade, quality of work 6. American, social status 3. Teacher's ratings: intelligence 4, social adaptability 4, dependability 3.

Discrepancy: School work "inferior" although mental age would indicate ability for the fourth grade.

Louise is timid and easily worn out by excitement. Likely to appear bewildered when placed in a group. Is dominated by an older sister whom she worships, but who has reached an irritable stage in her development. Louise cannot please her in any way, although her endeavors are constant.

Showing effect of mental inertia.

Leonard. Age 13–6, mental age 13–10, I Q 103, seventh grade, quality of work 6. American, social status 5.

Teacher's ratings: intelligence 5, social adaptabillity 5, dependability 5.

Discrepancy: Both chronological age and mental age normal for grade, but school work has always been decidedly inferior.

Leonard's father, now dead, was a shiftless drunkard. The mother, ostensibly a nurse, leads an immoral life. Several cousins are feeble-minded. Leonard's smiling good nature and constitutional indolence are proverbial among his teachers. One wonders whether he ever did anything he was not compelled to do. In school he sits smiling pleasantly at others or staring off into space, dreaming. When prodded by the teacher he opens his book and stares into it vacantly. Perhaps the book is upside down. Occasionally he wakes up and gives a clear, fluent account of something he has read or seen, but he soon lapses again into his customary state of oblivion.

Showing effects of emotional instability or nervous tendencies.

Olivia. Age 12–6, mental age 13–2, I Q 105, seventh grade, quality of work 6. Portuguese, social status 4. Teacher's ratings: intelligence 5, social adaptability 4, dependability 4.

Discrepancy: Up to grade-age mentally and chronologically, Olivia has been promoted on trial from almost every grade.

Of Portuguese parents whose heads have been turned by prosperity. The mother says in her presence that Olivia has inherited her own nervousness and inability to do arithmetic. Needless to say, Olivia is nervous and cannot do arithmetic. She flounces around at her lessons, adds a bit, jiggles her desk, drops her books, picks them up, caresses her curls, etc. When in trouble pretends to be about to faint, but quickly recovers if threatened with punishment.

Emotional instability fully explains the discrepancy between intelligence and school success.

Joseph. Age 13–10, mental age 15–9, I Q 114, eighth grade, quality of school work 6. American, social status 5. Teacher's ratings: intelligence 4, social adaptability 6, dependability 6.

Discrepancy: Mental age above average for grade, but school work very unsatisfactory.

Joseph has two sisters who are feeble-minded and blind. Two of his three brothers, also feeble-minded, are dead. The third brother is a "movie" star of national fame. *Joseph's* mother is a kindly faced woman who has been deserted by her worthless husband, and supports herself by taking in washing. *Joseph* himself is a bookworm, reading everything he can lay his hand on from Sunday-School books to encyclopædias. His mind is an exhaustless reservoir of unrelated facts. Psychopathic symptoms. Suffers at times from the idea of persecution, at which times he refuses to do any school work or even to talk.

Effect of home "spoiling."

Gordon. Age 5–7, mental age 6–6, I Q 116, first grade, quality of work 5. American, social status 3. Teacher's ratings: intelligence 5, dependability 5.

Discrepancy: School work "inferior," although in grade corresponding to mental age.

Gordon is the son of a minister and badly spoiled from petting and humoring. Attitude of condescension toward school work. Attention poor; easily fatigued; bad sex habits.

Bernard. Age 7–1, mental age 7–8, I Q 108, first grade, quality of work 5 to 6. Portuguese, social status 5. Teacher's ratings: intelligence 4, social adaptability 4, dependability 5.

Discrepancy: School work below average, although mental age is a half year above normal for grade.

Bernard is a handsome child; the other five in the same family are very homely. Has always been petted and allowed to have his own way.

Showing influence of physical defects.

Roy. Age 15, mental age 14–8, I Q 98, seventh grade, quality of work 6. American, social status 4. Teacher's ratings: intelligence 6, social adaptability 5, dependability 5.

Discrepancy: Mental age a little above the average for his grade, but school work "inferior."

Thin, anæmic, and sickly-looking. Almost hydrocephalic in appearance, with protruding eyes and open mouth. Very deaf and resents it. Fails to hear much of what is said during recitation, but will not admit it. At home has been alternately scolded and petted by a foolish mother, with the result that he has irritable and stubborn spells.

Madeline. Age 7–10 (?), mental age 6–2, I Q 79 (?), first grade, quality of work 7. Portuguese, social status 5. Teacher's ratings: intelligence 6, social adaptability 6, dependability 5.

Discrepancy: Although there is a question about Madeline's correct age, her mental age of 6 plus should enable her to do at least fair work in the first grade. She is making almost no progress.

Has suffered for years from chorea. Attends school until her movements become too uncontrolled and violent, stays at home for a few weeks, then returns to school. After a severe attack all she has learned in school seems to leave her.

Love affairs and day-dreaming.

Elmer. Age 14–2, mental age 14–3, I Q 101, seventh grade, quality of work 6. American, social status 4. Teacher's ratings: intelligence 5, social adaptability 3, dependability 4.

Discrepancy: Failing in work, but with mental age slightly above his school grade.

The discrepancy in Elmer's case was only temporary and was caused by a particularly severe case of "puppy love." The girl moved away, love's young dream was broken, and Elmer's work came back to normal.

Aldrich. Age 7–5, mental age 8–6, I Q 115, second grade, quality of work 6. American, social status 4. Teacher's ratings: intelligence 3, social adaptability 3, dependability 4.

Discrepancy: Mental age average for grade but school work "inferior."

A dreamer and not interested in school work. Poor foundation in first grade. Teacher's estimate of intelligence agrees with the I Q. Unusual vocabulary and information.

Summary. It appears that lack of self-confidence, personal traits which tend to cause over-rating or under-rating, mental inertia, physical defects, emotional instability, and psychopathic heredity are the most common causes of discrepancy between mental age and quality of school work. Unfavorable emotional attitude toward the teacher, the effects of which we have seen in other cases, did not appear in this series.

Of the 34 pupils for whom a discrepancy was found, 24 were boys, although as many girls as boys were tested. This would indicate either that teachers oftener misunderstood boys and oftener under-rate their school work, or that the school performance of boys is more easily influenced by physical or emotional defects than that of girls.

It is also interesting to note that although the tests were almost equally divided between children of American and foreign parentage (chiefly Portuguese), the latter account for only 11 of the 34 discrepancies. It appears, therefore, that the fact of foreign parentage does not greatly limit the usefulness of the Stanford-Binet scale as a measure of a child's educability. Several other Stanford students have made studies similar to that of Miss Preston's, involving in all nearly two thousand Binet tests. The data show convincingly that in the large majority of cases mental age offers a fairly accurate index as to the grade in which the child is fitted to do work of average quality. The index misses the mark to the extent of one grade in something like six to eight per cent of cases, to the extent of two grades in not more than one or two per cent of cases. In ninety cases out of a hundred it is accurate enough for all practical purposes. Even in those instances where it would be misleading, if taken as the sole criterion, the Binet test offers the best available starting point for reaching an understanding of the child's case.

For example, J. F. had been for months doing very inferior work in the first year of high school. The teachers and principal were at a complete loss to understand the case. Various remedies were tried, but without effect. The boy claimed that he was making every effort to do the work. Finally he was given a Binet test and was found to have a mental age well above that necessary for successful work in the ninth

grade. The principal then called the boy to his office, explained to him what the test had revealed regarding his ability, and suggested that it was time for him to "quit fooling" and get down to earnest work. The result was an immediate and surprising improvement in his class marks.

Sometimes the fault lies not so much in lack of application as in failing self-confidence. S. W., a boy of twelve years, had developed a sense of mental inferiority. His school work had gradually deteriorated until he was on the point of failing. Although it is ordinarily not permissible to give a child his Binet test score, the principal wisely decided to do so in this case. The boy was so encouraged by the information that he went to work with a new spirit and soon ranked above the average in his class.

Whether the child is working exactly up to his capacity, or above or below it, the mental test is equally necessary. Ernest, the first of Miss Preston's cases, is doing fair work, although considerably below the normal mental age for his grade. Unless this is known Ernest's efforts cannot be correctly appraised. In such cases as Roy or Madeline the teacher's attention is directed by the test to the possible influence of physical defect upon school work. A discrepancy like that shown by Jennie and Donald calls attention to the danger of over-rating the vivacious or under-rating the diffident child.

The case of Margaret. The case of Margaret, re-

ported by Strong, offers a classical example of the usefulness of mental tests in discovering the causes of poor school work.[1]

Margaret had just failed of promotion from the low-fourth grade. She was eleven years old, and tested at eleven by the Binet scale. With average normal ability, according to the test, her school work was nevertheless described by teachers as "hopeless." Her work in arithmetic and geography was especially poor. From January until May a small amount of special instruction was given her by one of Dr. Strong's students. Although the special instruction in arithmetic extended over only five months, and amounted to a total of only a few hours, Margaret's advancement was from third-grade work to fifth-grade work, as shown by the Courtis tests.

The trouble seems to have been largely one of emotional attitude. When the special instruction began "she was afraid of everything; she could do very little, she knew nothing positively. She held her eyes down, carried herself shrinkingly, was a typical 'fraid-cat.' — We started with a thoroughly disheartened child, whose enthusiasm and hope were about dead, and who was being taught many things in school without knowing facts and principles which should have preceded these things. We taught her the fundamentals of arithmetic, thus filling in all the gaps in her

[1] "The Development of Proper Attitudes toward School Work"; in *School and Society*, December 25, 1915, vol. II, pp. 926–34.

knowledge of that subject up to the work of her class. In doing so we allowed her to see her learning curves. The unmistakable objective fact that she was learning made her realize that she could learn, aroused her interest, gave her fresh enthusiasm, and presently there resulted a transformed child. As we have seen, the transformation affected not only arithmetic, but all her studies, her carriage and walk, her social attitude toward others, her entire character. From being hopelessly at the bottom of her class she now has a settled determination to lead that class. From every indication it appears that the actually brighter children will have to work to keep ahead of Margaret."

CHAPTER VIII

MENTAL TESTS OF SCHOOL LAGGARDS

SINCE the publication of Ayres's book, *Laggards in Our Schools*,[1] numerous statistical studies have been made showing the large proportion of children who are one, two, three, or more years retarded, and analyzing the factors which are responsible for the condition. It has become a matter of common information that more than ten per cent of the cost of tuition is for repeated instruction, that about a fourth of the pupils leave school with not more than a sixth-grade education, and that the ranks of the vocationally incompetent are recruited largely from children who in school were over-age for their grade. Yet the problem remains. The number of school laggards has decreased but little, and their needs are almost as little provided for as before the campaign in their behalf began. The extent of the problem will be apparent from an examination of typical statistical findings.

The number of over-age children. Professor Strayer by a uniform method secured data on the amount of retardation in 132 cities having a population of more than 25,000, and in 186 cities having a

[1] Ayres, Leonard P., *Laggards in Our Schools*. 1909. Russell Sage Foundation; pp. 236.

population less than 25,000.[1] His most important results are embodied in Table 20, which show for boys and girls separately the average per cent found retarded or accelerated by various amounts.[2]

	Sex	Normal (per cent)	Over-age 1 year (per cent)	Over-age 2 years (per cent)	Over-age 3 years (per cent)	Over-age 4 years (per cent)	Total over-age (per cent)	Total under-age (per cent)
25,000 (132 cities)	Boys	56	20	10	5	2	38	4
	Girls	60	18	9	3	1	32	4
Under 25,000 (186 cities)	Boys	54	20	11	4	2	38	4
	Girls	58	18	8	3	1	36	5
Average for all cities and both sexes		57	19	9.5	3.75	1.25	33.5	4.25

TABLE 20. RETARDATION IN 318 CITIES. (*Strayer*)

Table 20 shows that approximately one child in three is retarded, and only one in twenty-five accelerated. More than five per cent are retarded three years or more, and nearly fifteen per cent two years or more.

The actual amount of retardation is even greater than the figures indicate, because of the liberal basis on which retardation was computed. The standard adopted by Professor Strayer was that used by Ayres. By this standard a child is considered as making normal progress if in the first grade and not yet eight

[1] Strayer, G. D., *Age and Grade Census of Schools and Colleges.* Bull. 451, U.S. Bureau of Education, 1911; pp. 144.

[2] Professor Strayer has omitted fractional per cents, so that the combined totals do not quite equal 100 per cent.

years old, if in the second grade and not yet nine years old, and so on. Although this is the standard on which retardation is nearly always computed, it allows a margin of a half year all along the line. Actually, if the child begins school by the age of six and one half years and makes normal progress, he will be in the second grade by the age of seven and one half, in the third by the age of eight and one half, etc. Counting retardation on this basis, the figures for Salt Lake City, in May, 1915, were as follows:

Over-age 1 year..........	26.7 per cent
Over-age 2 years..	11.2 per cent
Over-age 3 years...	3.7 per cent
Over-age 4 years or more.	1.2 per cent
Total over-age.	43. per cent

That the retardation evil is not confined to large cities is shown by Strayer's figures for cities under 25,000; also by Berry's, Lurton's, and Morton's statistics for small towns in Michigan, Minnesota, and Nebraska. For 55 cities and villages in Minnesota, the number of children retarded one year or more (Ayres's basis of reckoning) was 30.9 per cent, and in 41 graded schools of the same State the number was 33.9 per cent.[1] The figures for 96 cities and towns of Nebraska,[2] taken together, are as follows:

[1] Lurton, F. E., "Retardation Statistics from the Smaller Minnesota Towns"; *Psychological Clinic,* 1911.

[2] Morton, W. H. S., "Retardation in Nebraska"; *Psychological Clinic,* December, 1912, and January 19, 1913.

Total pupils	25,449
Retarded 1 year	16.3 per cent
Retarded 2 years	7.6 per cent
Retarded 3 years	3.3 per cent
Retarded 4 years or more	1.4 per cent
Total retarded	28.6 per cent

In 227 cities and towns of Michigan, Berry found a total of 24 per cent retarded, and 3.5 per cent retarded three years or more.[1]

The amount of retardation in rural schools seems to be even greater than in cities and towns. Gaylor found 53.6 per cent of the children in 139 rural schools of an Illinois county at least one year retarded, and 28.4 per cent more than one year retarded.[2]

In 11 small cities in Illinois the number retarded two years or more was 20.7 per cent, as compared with 28.4 per cent in the rural schools.

Phelps found 28 per cent of 13,626 rural-school children in California retarded on the liberal standard used by Ayres. The number retarded three or more years was 2.5 per cent.

The supposed causes of retardation. Retardation cannot be properly dealt with until its causes are understood. The causes emphasized by Ayres and the majority of other investigators are physical defects,

[1] Berry, Charles Scott, "A Study of Retardation, Acceleration, Elimination, and Repetition in the Public Elementary Schools of 225 Towns and Cities of Michigan"; *Seventy-ninth Annual Report* of Superintendent of Public Instruction (Michigan), 1915–16.

[2] Gaylor, G. W., "Retardation and Elimination in Graded and Rural Schools"; *Psychological Clinic*, 1910, pp. 40–45.

irregular attendance, late entrance, too high a standard, and lack of flexibility in methods of promotion. The usual view is expressed in the following conclusions which Dr. Gulick drew from the investigation of Ayres: (1) "That the most important causes of retardation can be removed"; (2) "that relatively few children are so defective as to prevent success in school or life." These assumptions are contradicted by the findings of all who have investigated the subject by the use of mental tests.

It is interesting to examine the causes which are most often mentioned by teachers and superintendents. In the case of 108 laggards in the Salt Lake City schools, the causes most often named were the following, given here in order of frequency of mention by teachers: — poor home condition, physical defects, transferring from another school, retarded mental development, difficulty with the English language, lack of application, irregular attendance, laziness, late entrance, and delinquency.

Mental tests of these same 108 children showed an average mental retardation of three years. The large majority, indeed, were feeble-minded. Feeble-minded children do often come from poor homes, since often the parents of feeble-minded children are themselves feeble-minded. For the same reason, feeble-minded pupils shift frequently from one locality to another and attend irregularly. Because such children are feeble-minded, they enter late, show little applica-

tion in their school work, and tend to become delinquent.

Many similar questionnaire studies have been made and their findings are always essentially the same. All kinds of supposed causes of retardation are emphasized except the one important cause — inferior mental ability. Many teachers seem to hold views somewhat as follows: (1) All children are either normal or feeble-minded; (2) those who are normal (i.e., not feeble-minded) should make standard school progress; (3) those who are feeble-minded will bear readily recognizable ear-marks of their deficiency and will be unable to learn anything. It is not generally understood that many feeble-minded children present a normal appearance; still less that some ten per cent of school children of perfectly normal appearance have a grade of intelligence which is about halfway between that of the moron and the average normal child.

The real cause of retardation. Of Dickson's first-grade pupils who were eight years old or older, 68 per cent were below 80 I Q. Of Hubbard's fifth-grade pupils who were thirteen years old or older (i.e., two or more years retarded) 64 per cent were below 80 I Q. Of 50 over-age children tested by Williams in three California cities, 50 per cent had an I Q below 80, and 32 per cent were below 75. Of 174 over-age children tested in the schools of "X" County, California, 61 were below 70 I Q, 106 below 81 and 153 below 90. In the case of the 1000 unselected children on whom the

Stanford Revision was based, 97 were three or more years over-age on the Ayres standard. Of these, 78 per cent were below 80 I Q. Conversely, nearly all of those who were below 80 I Q were one or more years over-age for the grade in which they were located.

Dozens of such studies, larger or smaller, could be quoted. It is unnecessary, for all show the same thing: namely, that the over-age child is usually a dull child. Any one who desires additional proof need only test a large number of unselected children of a given chronological age, say twelve years, and note the school progress which those of various mental ages have made. Tables 21 and 22 show this for unselected children of eleven and twelve years.

Mental age	Grade								
	I	II	III	IV	V	VI	VII	VIII	Total
18							1	..	1
17						..	3	1	4
16					..	1	2	..	3
15				..	2	5	6	1	14
14				1	6	13	2		22
13			..	3	12	18	1		34
12			1	2	22	12			37
11			2	10	42	6			60
10		..	6	15	20	1			42
9	..	2	3	14	6				25
8	1	5	6	2					14
7	1	1	3						5
6	1							..	1
5	1			..	..			..	1
Total	4	8	21	47	110	56	15	2	263

TABLE 21. GRADE LOCATION OF 263 11-YEAR-OLDS BY STANFORD-BINET MENTAL AGE

These children were all eleven years old, chronologically. Correlation is .81

Mental age	Grade I	II	III	IV	V	VI	VII	VIII	Total
18			..				1	1	2
17			..			..	3	2	5
16					..	1	7	4	12
15				..	1	3	8	5	17
14				1	4	10	11	4	30
13				..	3	23	3	..	29
12			..	2	19	21		1	43
11			1	5	26	14			46
10	..	..	2	10	26	4			42
9	1	1	7	9	4				22
8	..		3	1	1				5
7	2			1					3
6	1								1
5					..				
Total	4	1	13	29	84	76	33	17	257

TABLE 22. GRADE LOCATION OF 257 12-YEAR-OLDS BY STANFORD-BINET MENTAL AGE

These children were all twelve years old, chronologically. Correlation is .855

In the above tables, mental age 6 means 5–6 to 6–5, 7 means 6–6 to 7–5, and so on. The tables show that intelligence is the chief factor determining the rate of a child's progress. It also shows that the test result gives a fairly reliable indication of the school grade in which a child of a given chronological age will be able to do the work. The correlation between mental age and grade is .81 for the eleven-year-olds, and .855 for the twelve-year-olds.

The 257 pupils of the twelve-year group belong in the sixth grade by chronological age. However, 47 are in the fourth grade or below; i.e., two or more years retarded. All but three of these are mentally below twelve years, and all but 9 mentally below eleven. Of

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the 17 twelve-year-olds in the seventh or eighth grade (two years accelerated) all but one are mentally fourteen or above. Similarly for the eleven-year olds. Those who are accelerated show a high mental age, those who are retarded test low.

Feeble-minded school children. We have seen that the large majority of over-age children are below average intelligence. Such children may be classified as dull, border-line, or feeble-minded. While the feeble-minded group is much the smallest of the three, it gives rise to the most difficult educational and social problems. What these problems are can best be illustrated by the results of a typical survey of feeble-minded children in a small school system. That of "X" County, California, will serve the purpose.[1]

"X" County enrolls somewhat more than five thousand pupils in its public schools. Approximately twenty per cent of these attend rural schools having less than three teachers. The other eighty per cent are divided not very unequally among a half-dozen small cities. It was not possible to test all these children, nor was it necessary to do so in order to ascertain the approximate number of feeble-minded. The plan adopted was to test the suspected cases in all the rural schools of the county and in "Y" city, and at the same time to obtain data from all of the other

[1] Terman, Lewis M., Dickson, Virgil, and Howard, Lowery. The results are published in a bulletin of the California State Board of Charities and Corrections entitled *Surveys in Mental Deviation*, 1918, pp. 19–45.

cities of the county of such a kind as would indicate whether the proportion of mental deficiency in those cities differed greatly from that found in the schools where mental tests were given.

The first step was to obtain from the teachers information which would make possible the location of suspected cases. At the request of the county each teacher furnished the following data for each pupil enrolled in her class: name, age, grade, years in school, birthplace and occupation of parents, and ratings of the child for intelligence and quality of school work as very superior, superior, average, inferior, and very inferior.

The information thus secured made it possible to eliminate eighty or eighty-five per cent of the children from consideration, because of their obvious normality. In most classrooms it was necessary to test only ten to fifteen per cent of the children in order to avoid the risk of missing any defectives. In certain rooms, however, more were tested. The rule followed was to test every child who was rated by the teacher as seriously below average in either school work or intelligence, and to test all who were seriously over-age for their grade, whatever the teacher's rating. Of the 1464 pupils enrolled in the rural schools and "Y" City, 174 (12 per cent) were tested. The resulting I Q's were as follows:

I Q............	40–49	50–59	60–69	70–79	80–89	90–99	100–109	110–up
Number........	3	13	45	45	48	15	4	0

The majority of cases falling below 70 may be considered feeble-minded. The range 70–79 is composed largely of border-zone cases. Those between 80 and 89 are practically always normal, but dull; those between 90 and 109 may be called average-normal.

In the classification of the 174 suspects only those were placed below the border-zone group who were rather definitely feeble-minded. Correspondingly, those who were above suspicion of feeble-mindedness were placed above the border-zone group. On this basis 62 children, or 4.24 per cent of the enrollment of 1464, were classified as feeble-minded, and 29 (1.98 per cent) as border-zone cases.

Grade progress of the feeble-minded. The school progress which the 62 feeble-minded children of "X" County were making is shown in Table 23. In this

Age	Grade								Total
	I	II	III	IV	V	VI	VII	VIII	
6	2								2
7	2								2
8	3	1							4
9	2	1							3
10	3	3							6
11	2	1	3	1					7
12		2	1	5	2	1			11
13		2	3	3	4	2			14
14				3	2	2			7
15				1		1	1		3
16							2	1	3
Total	14	10	7	13	8	6	3	1	62

TABLE 23. AGE-GRADE LOCATION OF 62 FEEBLE-MINDED CHILDREN

table, as before, age 6 means 5–6 to 6–5; age 7 means 6–6 to 7–5, etc.

From the facts set forth in the above table one could safely infer, even without the aid of mental tests, that a majority of these children are very inferior. Moreover, for two reasons the age-grade distribution of the

	Grade								
Mental Age	I	II	III	IV	V	VI	VII	VIII	Total
4	4								4
5	7	2							9
6	2	2	1						5
7	1	4	3	1					9
8		2	3	8	7	4			24
9				4	1	2	2	1	10
10							1		1
11									
12									
13									
14									
Total	14	10	7	13	8	6	3	1	62

Table 24. Grade Distribution of 62 Feeble-Minded Children by Mental Age

children represents their mental status too favorably: (1) The younger feeble-minded have not yet had time to fall below grade. The feeble-minded of ages 6 and 7, for example, are represented in the table as being up to grade. (2) The majority of the feeble-minded are in reality above the grade where they can do satisfactory work. This is seen in Table 24, which shows that

these children who appear to be so badly retarded are, on the basis of mental age, greatly accelerated. While the average retardation on the basis of chronological age is 2.5 years, the average acceleration on the basis of mental age is 2.2 years.[1]

Some exceptionally difficult classes. The following schools will give an idea of the problems which face some of the teachers of "X" County:

Rural School A. Pupils enrolled, 41. Of these, 18 were so seriously over-age and were rated so low by the teacher as to be classed as suspects. Of the 18 tested, 13 were feeble-minded and 3 of borderline intelligence. One family furnished 6 of the feeble-minded, another 4. The school enrolls one pupil in the first grade who is 10 years old and has been in that grade for four years. Two other pupils have completed only two grades in the six years they have attended. They are now at the age of almost 13 years in the low third grade and are doing unsatisfactory work there. Another who is 16 years old and in the seventh grade has only nine-year intelligence. His intelligence is barely equal to fourth-grade work.

Rural School B. Eighty-four pupils, 3 teachers. Of the 12 children tested as suspects, 4 were feeble-minded, 5 were border-zone cases, and 3 were dull-normal. One family furnished a moron and a border-liner; another furnished a moron, a border-liner, and a dull-normal. A moron girl in this school has an insane mother. The girl is normally attractive in appearance and has reached the stage of adolescence.

Room P, City "Y." This is a fourth-grade class enrolling 39 pupils, 23 of whom are over-age for their grade. Five of these are from three to five years retarded. The ages of the

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[1] Compare Tables 23 and 24 with Tables 28 to 35, pp. 159–162.

39 pupils range from 9 years to 16 years. Of 5 suspects tested in this room 2 were feeble-minded and 3 border-zone cases. Another, the lowest of all according to the teacher's estimate, was absent and could not be tested.

Although these three schools represent an extreme situation, there are undoubtedly thousands of teachers in the United States whose problem is made fully as difficult by the presence of backward and feeble-minded children. Sometimes the teacher's position is jeopardized because of her inability to give such pupils the expected mastery of school work. Often she is penalized if her percentage of failure is much higher than the average. Everywhere the emphasis is on keeping children up to grade, rather than on finding work which is suited to their abilities.

How many children are feeble-minded? In "X" County the proportion of feeble-minded children is not far from four per cent of the total enrollment. Fortunately this is an exceptional condition. The proportion usually found is between one and three per cent. In a partial survey of mental deficiency in the schools of San Luis Obispo, California, we found two per cent of the school children mentally defective. The Stanford tests of 1000 unselected children in five cities gave one per cent below 70 I Q, and two and one half per cent below 75 I Q. Probably one and one half per cent of the 1000 cases were feeble-minded. Among Dickson's first-grade children the proportion of mental deficiency was very considerably higher

than this: Of Hubbard's 79 fifth-grade pupils, 4 tested below 70 I Q.

Other investigators in large number have found similar ratios of mental deficiency. After an exceptionally thorough study of feeble-mindedness in the public schools of Oakland, California, Mrs. Hicks classifies three per cent of the children of that city as feeble-minded. Dr. Macfie Campbell's survey of a certain district in Baltimore resulted in a classification of three per cent as having "pronounced mental defect." Dr. Goddard, after a number of investigations in eastern cities, including New York City, estimates that about two per cent of the school children in any average city will be found feeble-minded.

Strikingly similar results have been found for several rural districts. Dr. Wilhelmine Key, in a study of a county in Northeastern Pennsylvania, finds 3.2 per cent of the population mentally defective. In a survey of mental deficiency in Porter County, Indiana, by the United States Public Health Service, 2185 children were given a Binet test. Approximately one per cent were classified as feeble-minded, and another large group as doubtful. A similar investigation was made by the United States Public Health Service in New Castle County, Delaware. Abbreviated mental tests were given to all the 3793 children enrolled, and on the basis of these tests the seriously retarded cases were sifted out for a complete Binet test. As a result, 1.8 per cent were class-

ified as being of institutional grade, not counting about a fifth of 1 per cent who were epileptic. *We can conclude then that on an average two or three children out of a hundred are so poorly endowed in intellectual ability as to render their social competency a matter of extreme doubt.*

This figure should not be surprising, considering the number of children who are over-age three years or more. The following per cents on this point are typical:

	Over-age 3 years or more (per cent)	Over-age 4 years or more (per cent)
318 cities (Strayer)	5.25	1.5
Salt Lake City (Survey Report)	4.9	1.2
96 Nebraska cities and towns (Morton)	4.7	1.4
227 Michigan cities and towns (Berry)	3.	?
13,626 California rural school children (Phelps)	2.5	1.
"X" County, California (Terman)	5.2	2.

Probably eighty per cent of those who are retarded four years or more, and fifty per cent of those retarded three years or more, are feeble-minded. Many others are feeble-minded who have not attended school long enough to become seriously retarded. In "X" County fifty-eight per cent of the feeble-minded were not more than two years over-age.

Criteria of mental deficiency. Certain statements made in the preceding discussion may appear to be based on the assumption that all children may be classified as definitely normal in intelligence or definitely feeble-minded. No such assumption, however, has

been intended. The distribution of mental ability is "continuous," by which is meant that there is no definite line of demarcation between the imbecile, the moron, the dull, and the normal. Each group shades into the other by imperceptible degrees. The number of individuals to be classified as feeble-minded will depend largely on the standard of classification used. When 75 I Q is taken as the dividing line, the number of feeble-minded is about two and a half times as great as when 70 I Q is taken. If 65 I Q is used, the ratio of feeble-mindedness is greatly reduced.

The different standards employed have given rise to serious disagreements among psychologists as to the proportion of feeble-mindedness in various social groups. The disagreement comes from the fact that the term "feeble-mindedness" is currently used in two very different senses. In one sense it refers to the possession of no more than a certain degree of mental (chiefly intellectual) capacity, as measured by some objective scale. This is the psychological definition. As commonly employed, the term "feeble-minded" has reference primarily to those who, because of inherent or early acquired mental weakness, "cannot compete on equal terms with their fellows," or "cannot manage themselves or their affairs with ordinary prudence." This is the social criterion. These two criteria, the psychological and the social, cannot be used interchangeably for the reason that ability to get on in the world depends upon many things besides

absolute mental capacity, such as health, looks, bearing, muscular strength, inherited wealth, sympathetic friends, economic and industrial conditions, the prevailing level of intelligence in those with whom the subject must compete, etc. However, experience shows that, on any reasonable standard as to what constitutes social competency, the outlook for children who test below 70 I Q is anything but favorable.

Feeble-mindedness and dullness not curable. The classification of school children as "feeble-minded" or " dull " can only be valid in case it is found that the individual who tests low at an early age will continue to test low in succeeding years. As is shown in chapter IX, re-tests of children after long intervals indicate that a child's brightness or dullness remains surprisingly constant.[1] The following re-tests are typical:

F. C., middle-grade imbecile, tested as follows:
Age 8–6, mental age 4–0, I Q 47;
Age 10–8, mental age 5–4, I Q 50.

V. J., high grade moron, tested as follows:
Age 8–6, mental age 6–0, I Q 71, grade 1;
Age 9–4, mental age 6–9, I Q 72, grade 2;
Age 11–6, mental age 8–4, I Q 73, grade 3;
Age 12–4, mental age 8–10, I Q 72, grade 3.

H. V., dull normal, tested as follows:
Age 11–0, mental age 8–10, I Q 80.5, grade 4;
Age 14–11, mental age 11–8, I Q 78, grade low 7.

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[1] See Figures 21 and 22 in chapter IX, showing growth curves of dull and feeble-minded children.

Grade expectancy of the feeble-minded. Because of the tendency of the I Q to remain constant, it is possible to forecast with a reasonable degree of accuracy the highest grade in which a dull or feeble-minded child will ever be able to do satisfactory work. It has been found that after the chronological age of fifteen or sixteen years the mental age increases little if at all. Making allowance for minor changes of a few points in I Q we are able on this basis to make such predictions as the following:

The child who tests at 60 I Q will in all probability never go beyond the mental age of nine or ten years (sixty per cent of 16 years = 9.6 years). Such a child will never be able to do good work above the third or fourth grade, although by the age of sixteen he is likely to be found in the fifth or sixth grade, promoted there because of age and size.

The child who tests at 70 I Q may ultimately reach a mental age of about eleven years, which corresponds roughly to median fifth-grade ability. Such a child by the age of sixteen may be able to do fair work in the sixth grade, after much repetition, but is likely to be carried by the lockstep of the school a couple of grades beyond this. However, we have found no I Q of 70 in the high school.

An I Q of 80 means an ultimate mental age of approximately twelve and one half years. A child of the 80 class will at best be able, by the time mental growth has ceased, to do fair or average work in the

seventh grade. A mechanical system of promotion and sympathy for his retarded condition may be expected to land him in the eighth grade, or if he remains in school long enough, even in the first or second year of the high school. However, such a child will never be able to do the work of the average high school with any degree of satisfaction.

The child who tests at 90 is near enough the average to make normal or almost normal progress through the eight grades, although there is some likelihood of his incurring retardation of a half year to a year. Such a child, if persistent, may also be expected to graduate from high school, although the difficulty of making normal progress there is somewhat greater than in the grades below the high school, due to the fact that his competitors in the high school are selected pupils.

Those testing between 70 and 80 (about five per cent of all children) compose the group which offers the most difficult educational problem. The majority of this group are not sufficiently subnormal to warrant their commitment to an institution, nor are they able to profit normally from the regular work of the school. They furnish the bulk of those who by the age of twelve or fifteen are two to four grades retarded. As noticeably over-age pupils, they are the object of every one's sympathy. Because of the universal desire to keep the retardation figures low, they are over-promoted to such an extent that they are rarely able to master their lessons. Tables 29 and 30 (pp. 159, 160)

show the grade location of children testing between 70 and 79. Practically the only pupils in these tables doing satisfactory work were those who were in a grade corresponding closely to the mental age. Those whose grade location corresponded to chronological age were almost never doing work of average quality for the grade.

Limitations of the special class. The remedy which has been most often urged for the ills of the over-age child is the special class. Although one or more such classes are to be found in nearly all the larger cities, the number is never sufficient to take care of more than a small fraction of the children who should attend them. To provide special teachers enough for all the seriously over-age children on the usual basis of twelve or fifteen pupils per teacher is quite out of the question. The most that the best cities have done is only a beginning. Even if the special class were as effective educationally as its most enthusiastic champions claim, it would still be an impossible solution of the problem because of the prohibitive cost. Moreover, the question inevitably arises whether the ultimate returns to society would not be greater if any funds available beyond those necessary for the support of the regular classes were used to provide special opportunity for children who are gifted.

One way to reduce the cost of special class instruction, which at present is about three times as high as in the regular class, is to establish central schools

exclusively for backward children. When the pupils are graded according to ability and type of defect, a class of twenty-five presents a no more difficult problem than a class of fifteen which enrolls children who are feeble-minded, epileptic, incorrigible, or physically handicapped as well as those who are merely backward.

Vocational training for backward children. However, the administrative aspects of the problem are secondary to the pedagogical. The important task for the school is to provide the kind of instruction suited to the capacity of inferior minds. Whether this is done by grouping the regular class into sections according to ability, or by providing special classes, graded or ungraded, does not greatly matter. The danger inherent in the present costly mode of attack is that we may exhaust all our good will on a handful of feeble-minded, and leave practically untouched the infinitely larger and more important problem of providing the dull with a kind of training which will make them social and industrial assets. The feeble-minded, in the sense of social incompetents, are by definition a burden rather than an asset, not only economically but still more because of their tendencies to become delinquent or criminal. To provide them with costly instruction for a few years, and then turn them loose upon society as soon as they are ripe for reproduction and crime, can hardly be accepted as an ultimate solution of the problem. The only effective way to

deal with the hopelessly feeble-minded is by permanent custodial care. The obligations of the public school rest rather with the larger and more hopeful group of children who are merely inferior.

It should be clearly understood that individuals of inferior intelligence are not necessarily undesirable members of society. Indeed, the world has abundant use for them. A large proportion of the tasks in the modern organization of industries can be as well performed by individuals of the 70 or 75 I Q class as by those of superior intelligence, and with more satisfaction in the performance. Mentality of eleven years is ample for ordinary kinds of unskilled labor, and many of the semi-skilled trades are within the reach of those who test a year or two higher.

To make the most of this grade of ability, however, it must be trained. For children who test below 75 or 80 I Q, genuine vocational training should largely replace the usual curriculum of the upper grammar grades. Nothing beyond a certain amount of relief to the regular teacher is gained by segregating them in special classes, unless their course of study is at the same time vocationalized. Merely the introduction of a little basketry or other "handwork" does not serve the purpose. Although there are occasional happy exceptions to the rule, the average special class gives the backward child little that will be of direct service to him in the world. Often, indeed, it gives him little or nothing beyond the scope of the regular curriculum.

The following case is a typical illustration of the school's problem in dealing with over-age children:

M. is a Portuguese boy of 16 years. We first tested him when he was 10 years of age. His I Q was 74. He was in the third grade, where his work was very unsatisfactory. We tested him again when he was 14½ years old and in the sixth grade. At this time his mental age was 10–5 and his I Q 72. As would be expected, his work in the sixth grade was very inferior. By mental age he belonged in the high-fourth or low-fifth grade. Recently M. left school at the age of 16 years, after promotion to the seventh grade. It is certain that had M. remained in school indefinitely, he would never have been able to master the work required for graduation from the eighth grade. The school which he attended (a rural school) had done all it could for him by the usual methods. His teachers were unusually capable and conscientious. He had been given a fair trial at the regular curriculum and, in spite of his best efforts, for M. is an industrious lad, he could not make headway with it. He goes out into the world with no further equipment from his schooling than the ability to read, write, and do the fundamental operations in arithmetic. Some children who test as low as M. would be rated as feeble-minded. No psychologist would so classify M. Intellectually inferior he certainly is, but as far as his intelligence goes, it is sound. About ordinary affairs his judgment is dependable, and he is steady, industrious and anxious to make good. There are probably many kinds of semi-skilled work in which he could succeed. For none of these has he received any preparation. After nine years in school, he faces the world with no vocational asset but his God-given brawn. There are approximately a million children like M. in the public schools of the United States.[1]

[1] For other descriptions of dull and feeble-minded children see Terman, Lewis M., *The Measurement of Intelligence.*

CHAPTER IX

THE I Q AS A BASIS FOR PREDICTION

Prediction the essence of science. The essential characteristic of scientific knowledge is that it can be used as a means of predicting what will happen when certain conditions are given. Primitive man lived largely in a world of apparently chance events. The progress of enlightenment is measured by man's ability to find law and order in what seems to be but a chaos of happenings. The sciences of physics and chemistry, for example, have made possible thousands of predictions as to what will inevitably occur in the interaction of forces and elements, given such and such conditions. The passage of a current of electricity through water according to a certain procedure always gives hydrogen and oxygen. A bridge constructed of given materials according to given specifications will be able to withstand a certain definite amount of strain which can be foretold with reasonable accuracy.

The sciences that have to do with living matter, the organic sciences, have developed more tardily than the inorganic. The introduction of the scientific element into economics, sociology, education, and psychology is still more recent and far less complete. Education, especially, remains almost wholly on an empirical basis. Teachers have been too content to believe

in "miracles," instead of searching for the order and inevitable sequence which will make prediction possible. Some teachers even seem to prefer empiricism to science, and to derive satisfaction from the fact that child nature contains so many unknown quantities. To such persons the proposal to develop a science of mental growth which would enable us to forecast a child's future may even seem repugnant. It runs counter to the deep-seated and blind faith that anything is possible for any child; that the material with which education works is uniform; and that processes alone count.

Compared to the obvious variety of the world of adults, with its healthy and its sickly, its geniuses and its incompetents, its moral leaders and its criminals, the world of cradle or schoolroom does indeed present a homogeneous aspect. But the uniformity is one of appearance only. Mental tests are showing that the variety is there, and that it bears certain definite relations to the variety found among adults. To the extent that differences among children are measureable, and to the extent that these differences tend to persist, prediction is possible. It is evident, therefore, that one of the most fundamental problems of psychology is that of investigating the laws of mental growth. When these laws are known, the door of the future will in a measure be opened; determination of the child's present status will enable us to forecast what manner of adult he will become. The entire

program of educational treatment which should be accorded a given child hinges on such possibility of prediction.

Limitations of prediction in psychology. It must be admitted, however, that the laws governing the development of many mental traits are still little understood, and that tools for their exact measurement are far from satisfactory. We shall concern ourselves here only with the prediction of future intellectual status. The Standardization of the Binet scale on the basis of age-norms makes it a suitable instrument for the investigation of mental-growth curves. By applying it repeatedly to the same children, we can find out whether constancy or irregularity rules. Prediction hinges on the question whether a child who is found by the test to be a given per cent above or below the mental level normal for his age continues to be accelerated or retarded to the same degree. The answer is found in the extent to which the I Q remains constant.

Before presenting our data on re-tests there is one point that should be made clear; namely, that minor discrepancies in the results of successive tests do not necessarily imply corresponding irregularity of mental growth. Mental measurements are not and never will be made with the exactness which is possible in the physical sciences. "Accidental" and imponderable factors are always present to invalidate the result in some degree. This would be true even if the measuring scale itself were perfect, for the child himself is a more

or less variable factor. His performance in the tests may be influenced by conditions of health, the previous night's sleep, fatigue, timidity, anxiety, grief, attitude toward the examiner, or other special conditions. When the different tests of the same individual are made by different examiners, we have the additional disturbing influence of the personal equation in giving and scoring the tests.

Some have argued that such accidental influences largely invalidate the results of mental testing. Such persons take it for granted that an average child may test like a dullard if he is fatigued or sleepy, and that similar factors beyond our control may reduce the performance of a genius to the level of mediocrity. The question is one of fact. The results of re-tests show that, while theoretically all these influences may be present in some degree, their combined influence is in most cases small.

Constancy of I Q as shown by re-tests. Re-tests have been given to 315 children in the vicinity of Stanford University. To 46 of these children three or more tests have been given. In case of a child tested several times, each test has been compared with each of the others; for example, the first test with the second, third and fourth separately, the second test with the third and fourth separately, and the third test with the fourth. This gives in all 435 I Q comparisons.

The re-tests were not made as a separate investigation, but are such as have accumulated as a result of

various mental test studies carried on by many different Stanford University students over a period of years. For this reason the tests were made under an extraordinary variety of conditions. Thirty-three examiners contributed to the total number of tests.[1] Only twenty-eight per cent of the earlier and later tests were given by the same individual. There was no uniformity as regards time of day, place of testing, freedom from distractions, etc.

The intervals between tests ranged from one day to seven years and classify as follows:

Less than 1 year	86
1 to 3 years	138
3 to 5 years	85
More than 5 years	127

The ages of the subjects, counted at the time of the earlier of two compared tests, were as follows:

3 to 5–11	99
6 to 8–11	139
9 to 11–11	134
12 to 14–11	55
Above 15	8

[1]

Irene Cuneo	148
Terman	111
H. G. Childs	99
Laura Herron	46
J. H. Williams	40
L. S. Stockton	37
Dorothy Albrecht	36
Mary B. Chamberlain	34
Lowery Howard	18
W. M. Proctor	17
R. S. Roberts	15
Blanche Cummings	11
21 examiners, 1 to 8 each	78

The effect of the varying ages, also of wide intervals between tests, would presumably be to reduce correlations. The normal child who is reëxamined after an interval of five or six years earns his second mental age on other tests of the Binet scale than those taken in the first examination.

If the tests in the one or the other part of the scale are not properly standardized, there will be a discrepancy between the two I Q's due to this extraneous factor. We have therefore treated the various ages and intervals separately. Since the tendency for I Q to increase or decrease might be expected to vary according to the brightness of the child, the I Q groups of 89 or below, 90 to 109, and 110 or above, have also been treated separately.

Table 25 shows the frequency of various amounts of I Q change in the different groups of children classified (1) according to interval between the tests, (2) according to age at the time the earlier test was given, and (3) according to brightness. Increases in I Q of later as compared with earlier tests are tabulated as + changes, decreases as − changes.

Table 25 shows that it makes little difference whether the child was bright, average, or dull, how long an interval separated the tests, or what the age of the child was at the earlier test. The majority of the changes are for all groups relatively small. The salient facts for the entire series of re-tests may be summarized as follows:

Change in I Q	Interval				Age at first test				I Q Group					Total cases. Sum of columns 9, 10, and 11
	(1) 0–12 months	(2) 1–3 years	(3) 3–5 years	(4) 5–7 years	(5) Age 3 to 6	(6) Age 6 to 9	(7) Age 9 to 12	(8) Above 12	(9) Above 110 I Q	(10) 90–109 I Q	(11) Below 90 I Q	(12) Above 125 I Q	(13) Below 80 I Q	
Above +20			2		1		1	..	1			1	..	2
+20	..							..	..	..			..	..
+19	1							1	..	1			..	1
+18	..	..	..		..		..	..	..	..		..	..	..
+17	1	1	1		1		1	1	2	1	..	1	..	3
+16		1	1	..	1	..	1	..	1		1	1		2
+15	..	2		1	2	1		..	3			2		3
+14	1	..			1			..	1	..		1		1
+13	1	1	..		2	..	..	..	1	1	..	..		2
+12	1	2	2	..	1	1	2	1	3	1	1	2	..	5
+11	1	2	..	..	..	2	..	1	2	1	..	0	..	3
+10	..	1	3	1	1	..	3	1	3	..	2	2	1	5
+ 9	3	2	1	1	3	3	1	..	4	2	1	..	..	7
+ 8	1	3	4	1	3	1	4	1	6	1	2	3	1	9
+ 7	3	7	3	7	6	3	8	3	6	8	6	4	2	20
+ 6	1	6	2	5	3	4	5	2	3	7	4	1	1	14
+ 5	2	4	2	1	3	2	3	1	4	1	4	1	..	9
+ 4	6	8	3	1	9	1	5	3	7	5	6	2	2	18
+ 3	3	6	8	7	4	5	13	2	11	6	6	5		23
+ 2	2	6	5	4	3	3	9	2	9	6	3	7	..	18
+ 1	7	10	1	5	4	10	6	3	15	4	4	8	2	23
0	7	8	6	5	6	4	11	5	8	11	7	4	5	26
− 1	3	6	6	3	2	5	8	3	5	6	7	..	4	18
− 2	7	6	2	5	6	5	7	2	6	7	7	1	4	20
− 3	6	5	9	14	5	18	8	3	16	10	8	5	1	34
− 4	4	7	1	13	3	11	7	4	8	13	4	4	3	25
− 5	1	6	4	6	2	7	4	4	10	4	3	6	1	17
− 6	2	7	3	3	3	7	3	2	7	6	2	2	..	15
− 7	8	6	4	11	6	14	7	2	14	8	7	5	1	29
− 8	5	3	2	9	3	8	4	4	8	8	3	2	1	19
− 9	1	5	1	5	2	7	2	1	6	3	3	2	..	12
−10	2	1	1	3	1	3	1	2	4	3	..	2	..	7
−11	2	1		4	1	3	..	3	2	4	1	1	..	7
−12	..	2		2	..	1	3	..	..	3	1		..	4
−13	3	3	..	2	1	2	1	4	1	5	2	..	1	8
−14	1	..	1	5	1	3	2	1	2	4	1	2	..	7
−15	0	2	..	..	2				1	..	1	1	..	2
−16	..	2	1	..	3		..	..		2	1		..	3
−17		0	2	..	..	..	1	1	..	2	..	..	..	2
−18		2		1	1	1	1	..	1		2	1	..	3
−19		..	..	..		..	..	..	..	..			..	0
−20		1	1	..	..	1	1	..	1	1	..	..	..	2
Below −20		3	2	2	3	3	1	..	1	2	4	2	1	7
Total....	86	128	84	127	99	139	134	63	183	147	104	81	31	435

TABLE 25. SHOWING I Q CHANGES FOR CHILDREN RE-TESTED AFTER DIFFERENT INTERVALS, FOR CHILDREN OF DIFFERENT AGES, AND FOR CHILDREN OF VARIOUS DEGREES OF BRIGHTNESS

(1) *The central tendency of change is represented by an increase of 1.7 in I Q ;*
(2) *The middle fifty per cent of changes lies between the limits of 3.3 decrease and 5.7 increase ;*
(3) *The probable error of a prediction based on the first test is 4.5 points in terms of I Q.*

A more impressive way of expressing the agreement between earlier and later tests is by means of a correlation array, as is done in Table 26 for all the tests taken together. The correlation is .933. Those who ranked high in the earlier test ordinarily ranked high in the later, the average remained close to average, the low remained low.

Personal equation of the examiner. If an intelligence scale yielded consistent results only when used by the same examiner its value would be extremely limited. On the other hand, if results secured by different examiners in testing the same subjects give a high correlation, a most important requirement of validity has been met. Separate tabulation of those cases in which the earlier and later tests were made by different examiners yielded a correlation of .929, almost exactly the same as that for all the cases compared without regard to examiner. The following are typical illustrations:

Re-tests were made by Mr. and Mrs. Stockton of forty children who had been previously tested at various ages by various examiners. When the records were compared with the original tests, it was found that in

I Q at First Test	I Q at Second Test																								
	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	Total
170	..	..	..												..								1		1	2
165	..	..		..											1									..		1
160	..			..																				2		2
155	..	..		..																..	..					..
150	..		..	..												..	..	..	..	1	1					2
145	..			..												2	1	2	2	3	4	..	..	..		14
140	..	..	..	..												1	2	2	4	2	..	1	1	1		14
135	..	..		..	...										..	..	2	5	1	3	1					12
130	..	..	..	..											4	1	7	2	3	1						18
125	..	..		..								..	..	..	2	4	7	2								15
120	..	..		..					..		..	3	2	9	7	10	10									41
115	..	..		..					1	..	1	2	4	15	8	4										35
110	..	..	..	..				..	..	2	1	7	6	13		..										29
105	..	..		..				1	1	3	4	7	6	8	..	1										31
100	..	..	..	..			..	..	7	1	10	7	4	2	1											32
95	..	..		..	..		1	4	5	11	15	5		1												42
90	..	..	..	..	1	..	2	4	12	9	4	4														36
85	..	..	..	..	..	1	6	7	7	3	2	2														28
80	..		..	1	1	4	6	5	3	2	1	2	..													25
75	..	..		3	3	12	2	1		1			1													23
70	..	..	..	1	8	3	1														..					13
65	..	..	3	2	2																..					7
60	2	..	1	2																			...			5
55	..	..	..	..											..											
50	..		..	..																						..
45	1	..	..	..		..																				1
Total	3	..	4	9	15	20	18	22	36	32	38	39	23	48	23	23	29	13	10	10	6	1	2	3	1	428

TABLE 26. SHOWING AGREEMENT BETWEEN 428 EARLIER AND LATER TESTS * BY THE STANFORD-BINET. (Correlation .933)

* When Table 26 was made up 7 of the 435 records appearing in Table 25 had been misplaced. This accounts for the discrepancy in the grand totals of the two tables.

twenty-five of the forty cases the I Q had not changed more than four points, and in thirty not more than six points. The correlation with the earlier tests was .94.

Twelve children of Fresno, California, who were examined by Dr. J. H. Williams in 1915 were reëxamined by Miss Blanche Cummings. Dr. Williams was trained at Stanford University, while Miss Cummings had learned the Stanford Revision procedure by studying the directions in *The Measurement of Intelligence.* The results of the twelve repeated tests are shown in Table 27.

The coefficient of correlation between the tests of Dr. Williams and those of Miss Cummings, made over three years apart, is .96, Spearman method. Not only do the tests agree with each other; the school progress of the child agrees with both. The average or superior children make normal or more than normal progress; the inferior children less than normal progress. Other groups re-tested by different examiners have given similar results.

Influence of interval between tests. Table 25 shows that it makes little difference whether the compared tests are separated by an interval of a few months or several years. The central tendency of change and the proportion of changes included in a given range remain much the same. The only exception is that tests separated by more than five years show a greater tendency toward increase of I Q than is the case with shorter intervals. This is probably a

Examiner	Age	Mental age	I Q	Grade
Williams	11-1	8-4	75	4
Cummings	14-3	11-0	77	6 B
W	12-0	12-3	102	6 A
C	15-1	15-6	103	II High School
W	11-10	11-6	97	6 B
C	15-0	13-8	91	I High School
W	11-4	13-5	118	6 B
C	14-5	16-8	116	I High School
W	9-2	6-10	75	2
C	12-4	8-8	70	3
W	8-8	11-0	122	5 A
C	12-0	15-6	129	8 A
W	11-1	10-3	92	5
C	14-0	13-5	96	II High School
W	9-0	9-2	102	4 B
C	12-2	12-8	104	7 A
W	8-5	9-9	116	3
C	11-6	13-6	117	6 B
W	11-0	7-0	64	3
C	13-9	9-2	67	5 B
W	9-4	6-10	73	3 B
C	12-6	8-8	69	5 A
W	9-0	9-1	101	2 A
C	12-11	12-0	93	5 A

TABLE 27. SHOWING AGREEMENT BETWEEN THE EARLIER AND LATER TESTS OF TWELVE CHILDREN

Second test after an interval of three years. (Correlation .964)

spurious result due to the fact that in case of intervals of this length the first test was made by a form

of the Binet scale differing slightly from that used in the later tests.

It is rather surprising that children profit little in a re-test from their experience in the first test. One would naturally expect a considerable improvement due to their feeling more at ease and to the opportunity to think over their earlier mistakes and correct them. However, this advantage yields the child (on the average) only two or three points in I Q even when the test is repeated within a few days.[1]

Influence of brightness and dullness on the constancy of the I Q. There is a widespread popular opinion that bright children usually fail to hold their own, and that the dull are likely to improve with increase of age. Psychologists have more often expressed the view that it is the dull who fail to hold their own, and that the superiority of the bright probably increases. Table 25, which gives the I Q changes separately for the bright, average and dull (above 110, 90–109, and below 90), shows that the I Q remains almost equally constant for the three groups. The central tendency of change for the bright is + 0.7; for the average, + 3.0; and for the dull, + 1.2. The greatest tendency to gain appears with the average group, and the next greatest with the dull. The differences, however, are practically negligible.

[1] For further data on re-tests of kindergarten children see the article by Irene Cuneo and Lewis M. Terman, *Pedagogical Seminary*, 1918.

When those above 125 I Q and those below 80 I Q were treated separately, the central tendency of change was found to be − 0.5 for the former, and + 1.2 for the latter. The very dull actually gained a trifle more than the very bright. However, we have only thirty-one repeated tests for the low group to compare with eighty for the high group, and the low group contains very few cases below 60 I Q. It is possible that feeble-minded children testing below 60 are less likely to hold their own than those of milder degree of defect. As far as the school is concerned this possibly may be ignored, since there are relatively few in public school classes who test this low.

On the other hand, the I Q as determined by the Stanford-Binet (or any other intelligence scale yet devised) cannot *indefinitely* maintain its constancy in the case of children who are exceptionally superior. The child of fourteen years who tests at 139 has passed all the tests in the scale. Thereafter his I Q drops gradually to 122, which is the maximum possible for a subject of sixteen years who passes all the Stanford-Binet tests. Similarly, the child who tests at 161 has reached his maximum I Q at the chronological age of twelve years. This does not mean that his development ceases at this time, but merely that the Stanford-Binet does not measure it. Children who test at 130 are measured fairly accurately up to the age of fifteen years, or nearly as far as chronological age is counted. Since only about one child in a hundred rates as high

as 130, the scale is seen to offer a reasonably satisfactory measure for ninety-nine per cent of unselected children, and also for the remaining one per cent except during the later years of mental growth.

Limits of accuracy in prediction of mental development. From the frequency of the various amounts of change in I Q, as shown in Table 25, we can compute the average error which will be made in predicting the mental age or the I Q which a child will have at any later age. Speaking roughly, fifty per cent of the I Q's found at a later test may be expected to fall within the range between six points up and four points down. Half of this distance, or five points, is the probable error of an I Q for purposes of prediction.[1] Deviations of one, two, three, four, or five times the probable error may be expected to occur with the frequency given in the second column below.[2] The frequency actually found is shown in the third column.

Deviations as great as or greater than	Theoretical frequency (per cent)	Actual frequency (per cent)
One time P. E. (5 points).	50	50
Two times P. E (10 points).	27.76	16.6
Three times P. E. (15 points)..	4.3	6.2
Four times P. E. (20 points)....	.7	1.85

Since the central tendency of change is toward an

[1] Actually the P. E. is somewhat less than this, namely 4.5.

[2] See any textbook on statistical method; e.g., Rugg, H. O., *Statistical Methods Applied to Education* (Houghton Mifflin Co., 1917); pp. 391.

increase of a little more than 1 point, and since the changes above and below this are distributed fairly symmetrically, we may say, roughly speaking, that the chances that an I Q will either increase as much as six points or decrease as much as four points are one in two; that it will either increase as much as twelve points or decrease as much as eight points, one in five; that it will either increase as much as eighteen points or decrease as much as twelve points, one in twenty; that it will either increase as much as twenty-four points or decrease as much as sixteen points, one in a hundred and forty.

The above statements regarding the probability of different degrees of change occurring include deviations both above and below the central tendency of change. The chance for a deviation to occur in *one* direction is only half as great. For illustration, the chance that a child who tests at 85 will later test as high as 91 is one in four; that he will later test as high as 97, one in ten; that he will later test as high as 103, one in forty, etc. Similarly, the chance that he will drop to 81 or below is one in four; that he will drop to 77 or below, one in ten; that he will drop to 73 or below, one in forty, etc.[1]

It is evident, therefore, that the I Q is sufficiently constant to make it a practical and serviceable basis

[1] The chances of given deviations occurring vary so slightly for children of different ages at the time of the first test, also so slightly for intervals of different length between tests, that for practical purposes these factors may be left out of account.

for mental classification. At the same time it is not infallible. A single test does not give us certainty, but merely a high degree of probability. While the I Q it yields is extremely valuable in the tentative classification of children, it needs to be checked up by supplementary data and by re-tests. In certain types of pathological subjects the I Q may undergo large fluctuations. Epileptics, for example, frequently deteriorate from something like normality to middle-grade deficiency in the course of a few years.

Mechanical errors as a source of discrepancy. So close is the agreement in most cases between earlier and later tests that when a discrepancy of more than twelve or fifteen points is found it warrants a strong suspicion that an incorrect age has been given in one of the tests, or that arithmetical error has been made in adding credits to find mental age or in dividing mental age by chronological age to find the I Q. Mistakes of this kind are a more dangerous source of error than the personal equation of the examiner. Arithmetical errors can be greatly reduced by making all computations twice, a precaution which we consider absolutely necessary. The avoidance of errors due to incorrect age is by no means easy. Children in the lower grades occasionally do not know their age. Sometimes the age recorded in the school register is incorrect because of falsification by parent. The seriousness of this source of error is shown by the following illustration:

K. N. tested at the mental age of 5–2. The age given was 6–6, and the I Q was therefore computed as 79. This indicated a degree of dullness almost amounting to borderlinity. However, when the child was re-tested two years later the chronological age was given as only 7–6, instead of 8–6. Investigation disclosed the fact that 7–6 was correct and that the parents had falsified the age to secure earlier entrance. The mental age earned at the second test was 7–2 and the I Q 95. Correction of the age at first test raised the former I Q of 79 to 94, practically the same as that earned in the second test.

Do adenoids affect the I Q? It is very generally believed that adenoids seriously retard mental development, and that their removal is nearly always followed by a marked intellectual awakening. If such were the case the effect of removal should be to increase considerably the I Q. Among our re-tested children we have records of twenty-seven who underwent an operation for removal of adenoids or tonsils in the interval between tests. Comparison of the I Q's of earlier and later tests showed a central tendency toward a gain of two points and a fraction. There were ten losses and seventeen gains, but no gain larger than fourteen points, and only two larger than ten points. Although these results are too scanty to warrant a conclusion, they suggest that adenoids and diseased tonsils may give a child an exaggerated *appearance* of dullness. They are a chronic source of toxins which seriously impair physical vitality, and their removal probably adds to the child's vivacity

and to his interest in school work. This effect would easily be mistaken for real intellectual improvement. There are enough reasons why adenoids and diseased tonsils should be removed, apart from any effect on the I Q.

Investigations on a larger scale should be made to determine the effects on intelligence not only of adenoids, but also of such factors as malnutrition, chorea, loss of sleep, fatigue, hookworm,[1] malaria, etc.

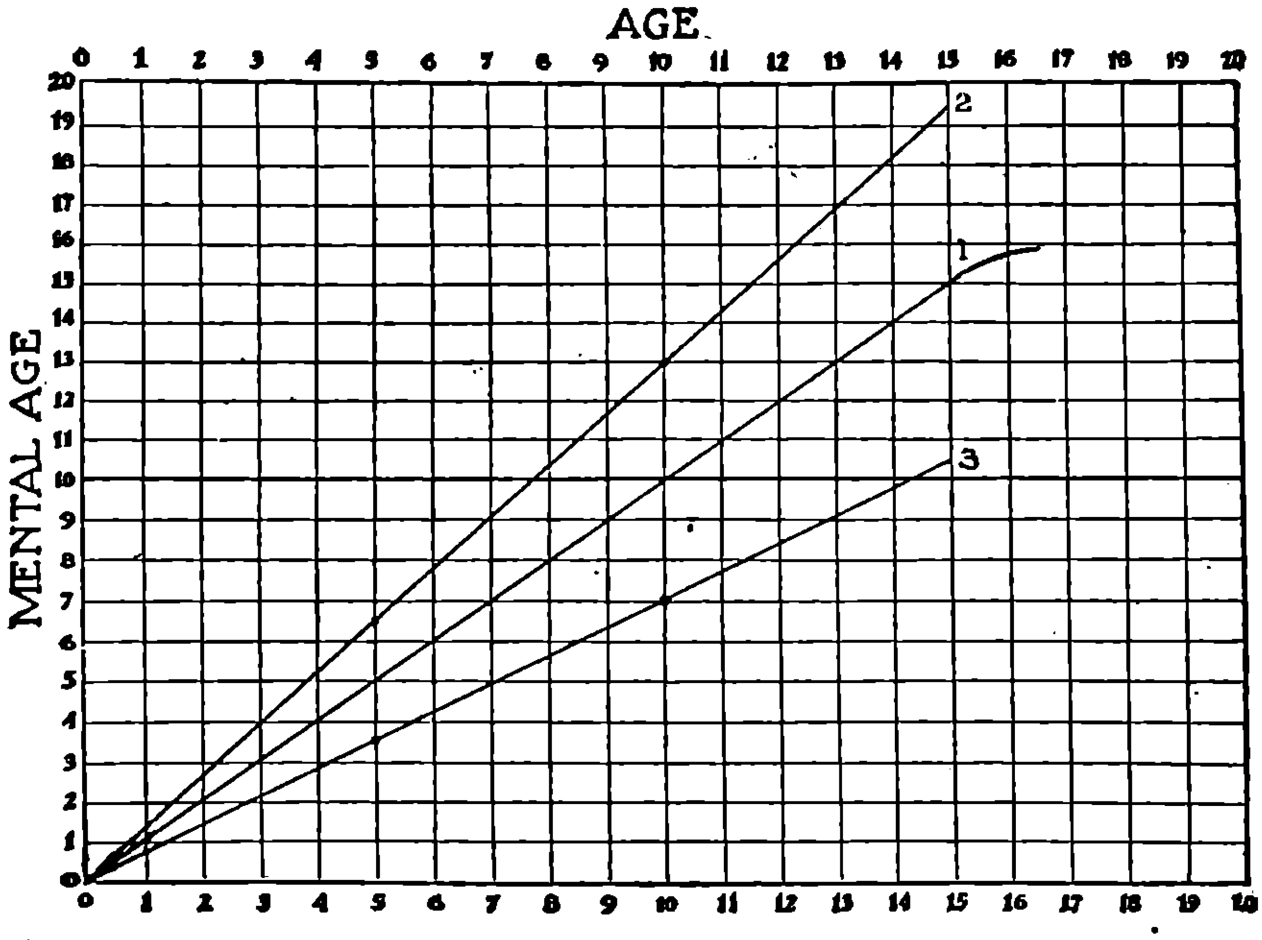

FIG. 20. MENTAL-GROWTH CURVES AS THEY WOULD BE IF I Q WERE CONSTANT

1. Mental-growth curve as it would be for a child who continued to test at 100 I Q
2. Mental-growth curve as it would be for a child who continued to test at 133 I Q
3. Mental-growth curve as it would be for a child who continued to test at 67 I Q

[1] An investigation made by Strong of the effects of hookworm disease on mental and physical growth did not afford very positive results, as re-tests were not given.

Curves of mental growth. If we had a perfect scale for determining the mental age level, and if the I Q remained absolutely constant, the " curves " of mental growth would be a straight line from birth to the point of mental maturity. The mental-growth curves for typically dull, average, or bright children would then be as represented in Figure 20. It will be observed that each of the hypothetical growth curves in Figure 20 maintains a certain *relative* distance from the heavy line representing the average-normal (I Q 100).

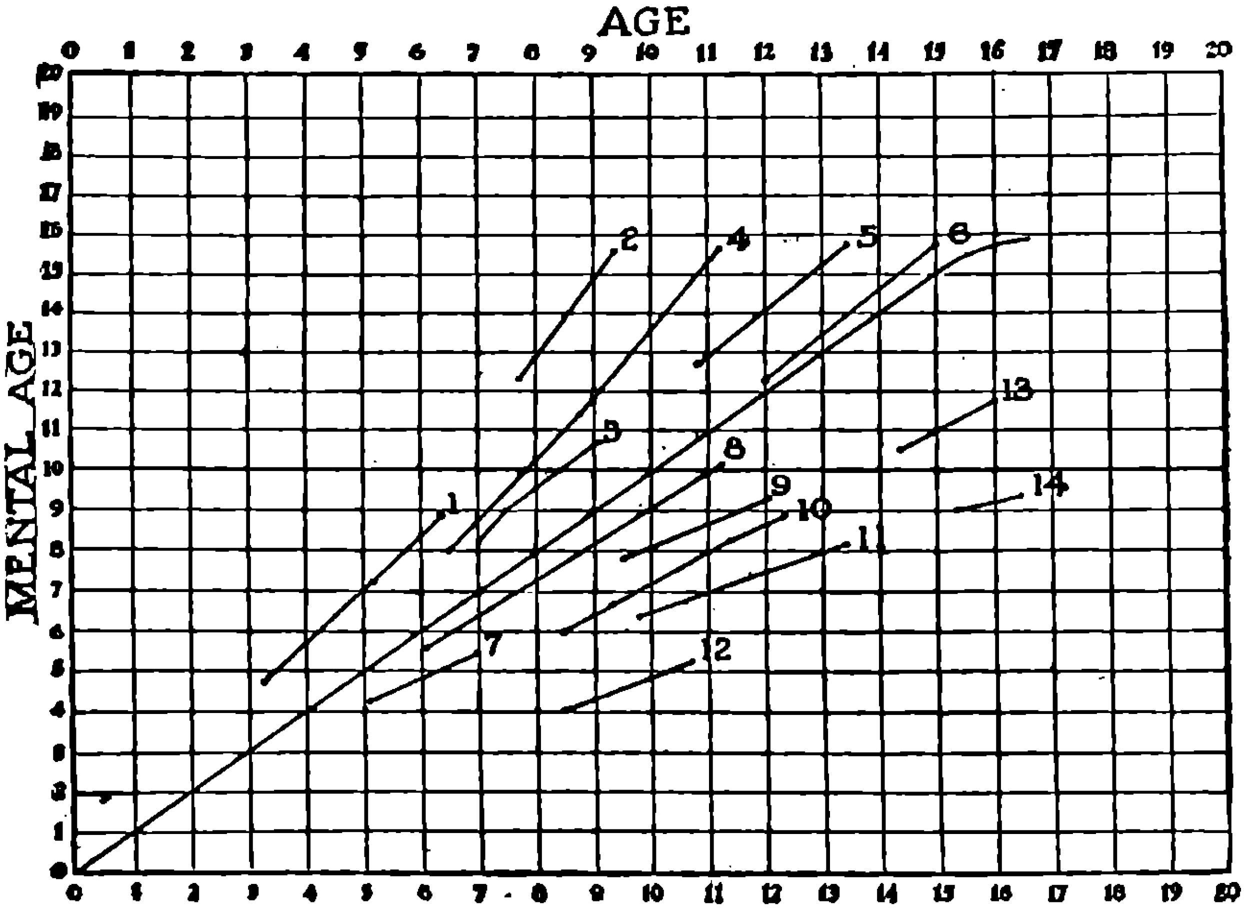

FIG. 21. ACTUAL MENTAL-GROWTH CURVES OF CHILDREN OF VARIOUS DEGREES OF BRIGHTNESS

1. Mental growth curve of superior child No. 17, Chapter XI
2. Mental-growth curve of superior child No. 11, Chapter XI
4. Granddaughter of an inventor and related to John Wesley
5. Son of a man of international fame
13. Member of a feeble-minded family of "X" County, California, which has long burdened the community with delinquents and paupers

The child's brightness or dullness is not at all indicated by his mental age, *but only by the ratio of mental age to chronological age.* The tendency is to remain a certain per cent above or below the normal.

We do not have an infallible measuring scale, and even if we had we should hardly expect the I Q (i.e., the ratio of mental age to chronological age) to maintain perfect constancy. Accordingly, mental-growth curves can only be expected to agree roughly with those shown in Figure 20. Figure 21 shows actual mental-growth curves found by repeated tests of children of various degrees of brightness.

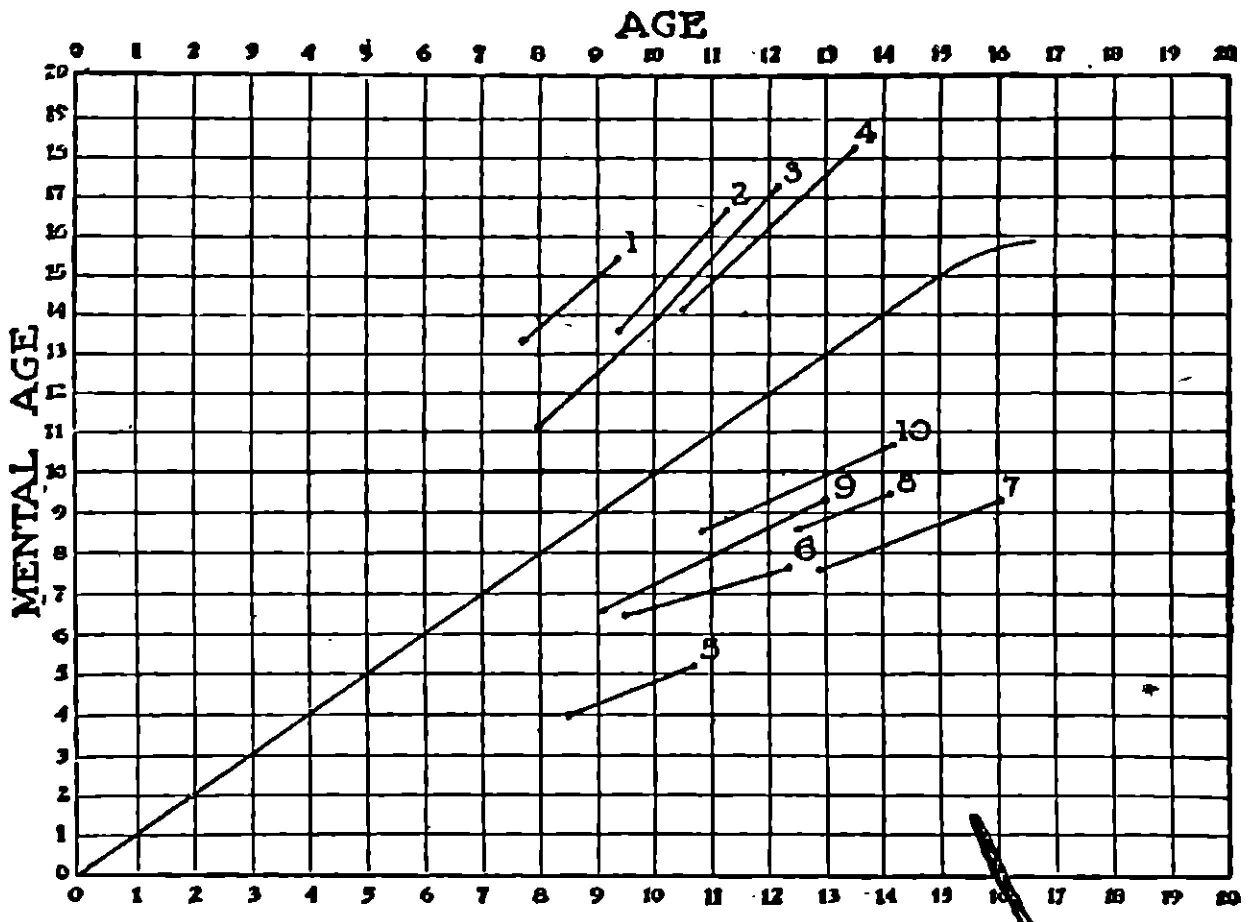

Fig. 22. Mental-Growth Curves of Bright and Dull Children

2. Superior child No. 33, Chapter XI
4. Described in *The Measurement of Intelligence*, page 97
6. Enrolled in a special class. In the third grade at 12½ years
7. Enrolled in a special class. In the fifth grade at age of 16, but unable to do the work

Figure 22 contrasts two groups of children. Those below the normal line are all either feeble-minded or border-line cases, most of whom were attending special classes and none of whom was ever able to progress above the seventh grade. The lowest is an imbecile, barely able at the age of twelve years to read in the first reader. The bright group is as much above average intelligence as the dull group is below, but they attract far less notice in school.

Figure 23 illustrates how children in the same family ordinarily test close together. The mental-growth curves above the normal line represent two brothers

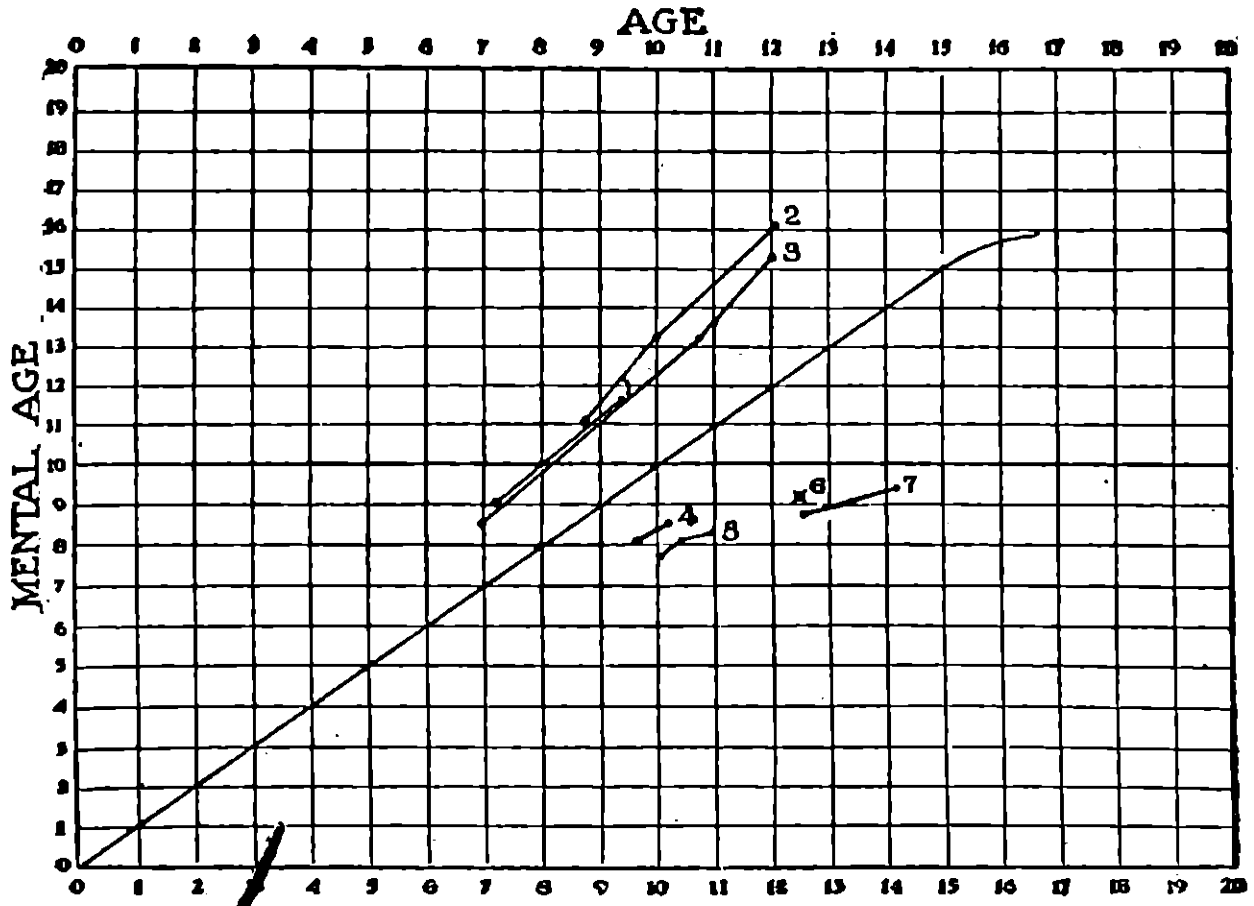

FIG. 23. MENTAL-GROWTH CURVES IN TWO CONTRASTING FAMILIES

1, 2, and 3. Two brothers and one sister of the W. family
4, 5, 6, and 7. Three brothers and one sister of the P. family
The cross represents a single test
The children of the two families attend the same school

and one sister of the W. family. The dots below the line represent the single tests of three brothers and one sister in the P. family. The children of both families attend the same school. Needless to say, the school success of the two groups is very different. The W. children are all accelerated, and are all rated "very superior" in quality of work; the P. children are all from one to three grades retarded, and are doing work rated as "inferior" or "very inferior."

Occasionally marked contrasts in mental ability are found in the same family, although this is the exception to the rule. Three such contrasts are shown in Figure 24. The unbroken lines, 1 and 2, represent a

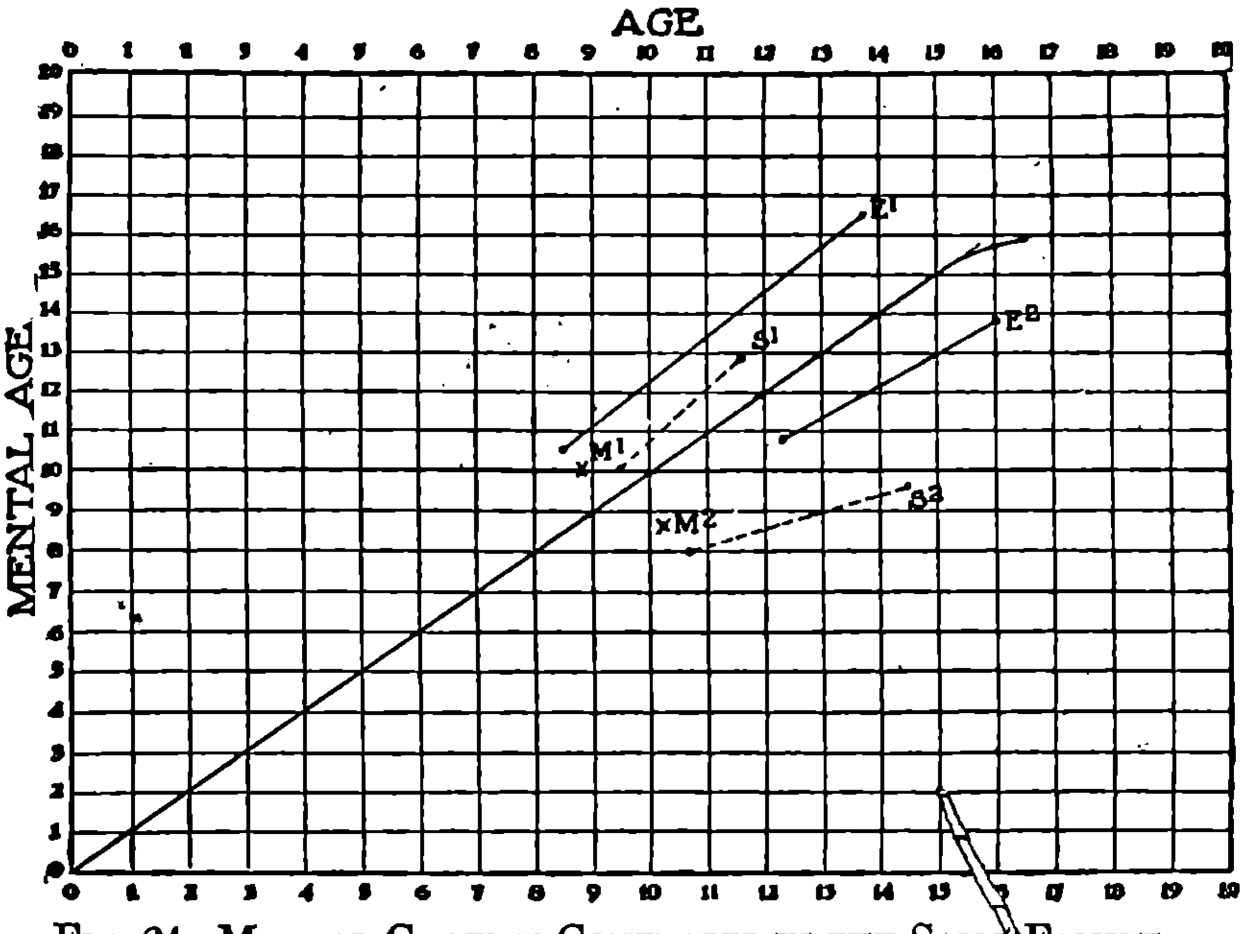

FIG. 24. MENTAL-GROWTH CONTRASTS IN THE SAME FAMILY

E^1 and E^2. Brother and sister in a Portuguese family. E^1 is leading his class in high school. E^2 failed to complete the eighth grade

M^1 and M^2. Brothers. M^2 is a year and a half older than M^1, but a grade behind him in school. Parents unable to understand his poor school work.

S^1 and S^2. Brothers.

brother and sister, the broken lines, 3 and 4, two brothers in another family. The two crosses indicate single tests of two brothers in a third family. In each case the contrast in school success was as marked as the contrast in the growth curves.

Figure 25 shows four exceptionally irregular curves of mental development. No. 1 and No. 4 represent conditions of mental disease (*dementia precox* and *epilepsy*). Normal children do not often show as marked irregularity as that found in No. 2 and No. 3.

The I Q as a basis for predicting school progress. The relative permanency of the I Q enables us to pre-

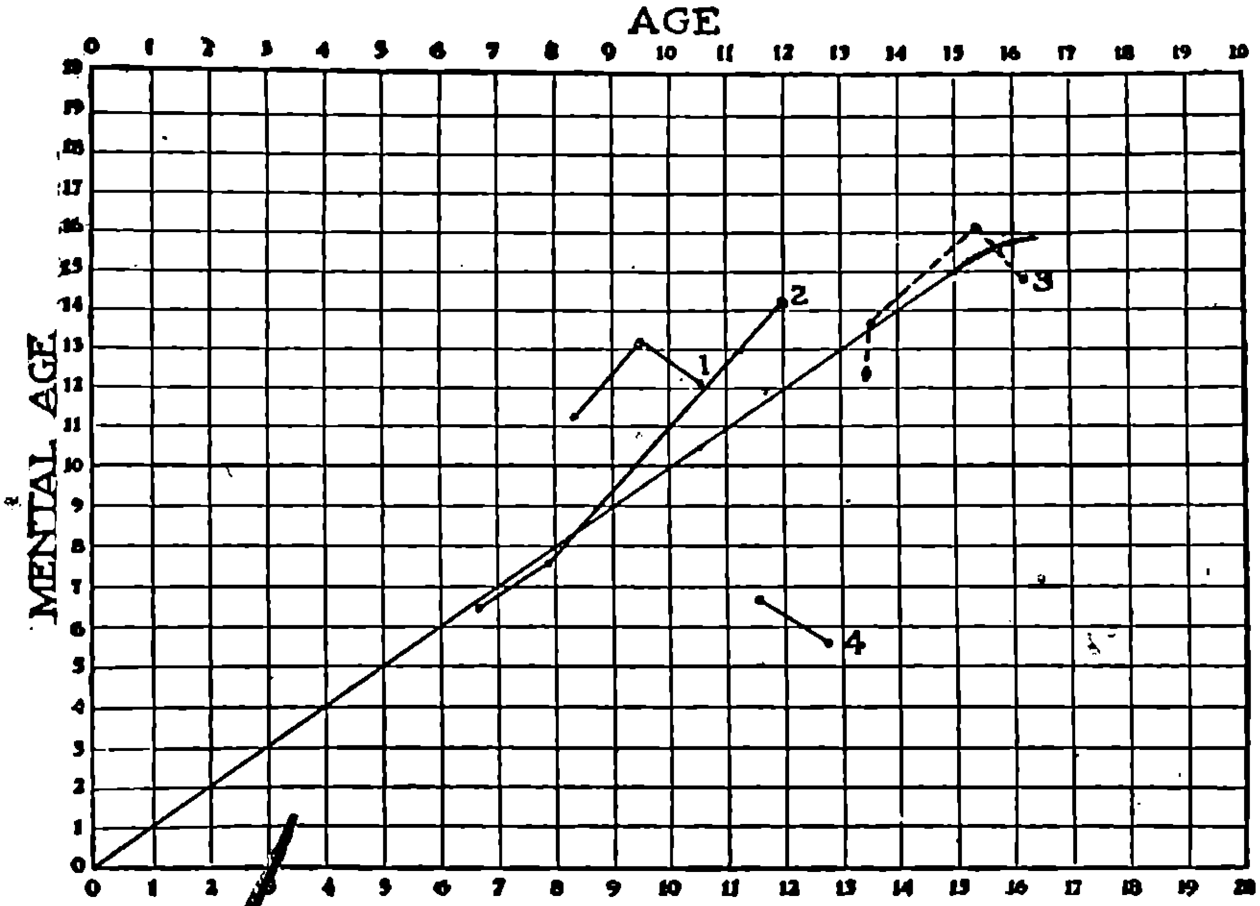

FIG. 25. FOUR EXCEPTIONALLY IRREGULAR GROWTH CURVES

1. A boy who at the age of ten showed symptoms of *dementia præcox*
2. A normal boy — cause of the irregularity not known
3. An adolescent boy of marked instability and neurotic symptoms
4. An epileptic girl, showing typicel epileptic deterioration

dict with some degree of approximation the mental level a child will attain by a given age. We have also seen that it is the mental level, more than anything else, which determines a child's proper location in the school grades. If schools were careful to grade children according to mental age it would be possible, knowing a child's I Q, to predict in what grade the child would be found at any given time in the future.

We have seen, however, that schools do not grade children as nearly by mental age as they should. While children of low I Q do become retarded, they are nevertheless usually found in a grade considerably above that corresponding to mental age. On the other hand, children of very superior I Q, while they are likely to be promoted somewhat beyond average children of their age, are usually found in a grade considerably below that corresponding to mental age.

Notwithstanding this constant tendency of teachers to promote children by age rather than by ability, the I Q nevertheless offers a fairly serviceable basis for predicting a child's later school progress. Tables 28 to 35 show the grade which children of various degrees of brightness had attained at various ages. The heavy squares running diagonally across each figure show the grades in which a child of 100 I Q normally belongs at the various ages. In all these tables, age seven includes children between six and one half and seven and one half years old, age eight those between seven and one half and eight and one half, etc.

Chronological Age	School Grade I	II	III	IV	V	VI	VII	VIII	Total
7	7								7
8	5								5
9	9	4							13
10	9	5							14
11	4	5	5						14
12	3	4	3	2					12
13		4	5	9	5	2			25
14		3	6	5	10	3			27
15			1	2	7	7	1		18
16				1	2	4	3	1	11
17					1	1	2	2	6
18						1	1		2
Total	37	25	20	19	25	18	7	3	154

TABLE 28. GRADE PROGRESS AT 50–69 I Q

Chronological Age	School Grade I	II	III	IV	V	VI	VII	VIII	Total
7	6								6
8	5	3							8
9	8	5	1						14
10	2	5	2						9
11	1	3	2	1					7
12		1	4	3	1	1			10
13			2	6	1	3			12
14				2	3	4	2	1	12
15				1	2	3	2	2	10
16					1	3	3	2	9
17							1	1	2
18									
Total	22	17	11	13	8	14	8	6	99

TABLE 29. GRADE PROGRESS AT 70–74 I Q

Chronological Age	School Grade I	II	III	IV	V	VI	VII	VIII	Total
7	6								6
8	10	3							13
9	7	5							12
10	1	6	3						10
11	1	3	7	4					15
12		1	5	6	5				17
13			2	7	10	6	1		26
14				1	3	4	2	1	11
15					2	2	6	2	12
16						1	1	6	8
17							2	2	4
Total	25	18	17	18	20	13	12	11	134

TABLE 30. GRADE PROGRESS AT 75–79 I Q

Chronological Age	School Grade I	II	III	IV	V	VI	VII	VIII	Total
7	16								16
8	13	6							19
9	7	15	2						24
10		4	9	1					14
11			5	9	6				20
12			1	4	14	1			20
13				3	16	9	1		29
14					7	5	5	5	22
15						2	8	8	13
16							1	5	6
17								1	1
Total	36	25	17	17	43	17	10	19	184

TABLE 31. GRADE PROGRESS AT 80–84 I Q.

Chronological Age	School Grade I	II	III	IV	V	VI	VII	VIII	Total
7	47	7							54
8	13	48	11						72
9	1	15	46	8					70
10			9	35	15				59
11			1	11	40	9	1		62
12				2	22	27	3	1	55
13					3	21	30	7	61
14						4	7	26	37
15						1	2	11	14
16								2	2
Total	61	70	67	56	80	62	43	47	486

TABLE 32. GRADE PROGRESS AT 95–104 I Q

Chronological Age	School Grade I	II	III	IV	V	VI	VII	VIII	Total
7	11	11	1						23
8		6	11	2					19
9			4	10	3				17
10			1	8	11	5			25
11					9	16	3		28
12						3	10	7	20
13						1	3	5	9
14								5	5
15									
16									
Total	11	17	17	20	23	25	16	17	146

TABLE 33. GRADE PROGRESS AT 120–129 I Q

Inspection of the above tables will reveal the following facts:

1. The lower the I Q, the greater the degree of re-

Chronological Age	School Grade I	II	III	IV	V	VI	VII	VIII	Total
7	2	5	5						12
8		1	6	3					10
9			1	5	4				10
10				1	3	2	1		7
11				1	1	4	6	2	14
12						2	6	3	11
13							1	3	4
14								2	2
15									
Total	2	6	12	10	8	8	14	10	70

TABLE 34. GRADE PROGRESS AT 130–139 I Q

Chronological Age	School Grade I	II	III	IV	V	VI	VII	VIII	Total
7	1	2	1						4
8		1	2	2	8	2			15
9			1	3	5	2	3		14
10					11	4	3	1	19
11					2	3	5	2	12
12							3	2	5
13							1	2	3
14									
15									
Total	1	3	4	5	26	11	15	7	72

TABLE 35. GRADE PROGESS AT 140–170 I Q

tardation. As we go from the 50–69 I Q group to the 95–104 group, the grade location gradually improves until it approximates the normal.

2. The I Q groups above 100 show a greater degree of acceleration the brighter the group. It will be noted,

however, that the acceleration of the bright group is not quite as great as the retardation of the dull. For example, the 120–129 children are not as far above the heavy squares as the 70–74 and 75–79 children are below. The same holds for the 130–139 group as compared with those of 60–69 I Q.

3. If the mental age of a given child in one of the retarded groups is computed, it will usually be found that the child is less retarded than he ought to be. When the mental age of a child in one of the bright groups is computed, it will be found that the child is less accelerated than he ought to be.

4. The typical child of 60 or 65 I Q tends to remain in the first grade until the age of ten or eleven years, and not to reach the fifth grade until the age of fourteen or fifteen years. By this time he has a mental level of only about nine years and is not able to do the school work satisfactorily above the third or fourth grade.

5. The typical child of 75–79 I Q reaches the fifth grade by the age of thirteen years, and if he remains in school is likely to be found in the eighth grade by the age of sixteen or seventeen. Nearly always, however, his grade location is higher than the mental age would warrant.

6. Children of 80–84 I Q usually remain two years in the first grade, and complete the eighth grade, if they complete it at all, one or two years behind schedule time.

7. On the other hand, children of 120–129 I Q are usually found either one or two grades accelerated. Nearly all of this gain, however, is made in the first year or two of school life. After the first year, they are held to the one-grade-one-year pace of average children. Even so, the central tendency is for them to complete the eighth grade at the age of thirteen.

8. The situation is slightly but not proportionately better for the I Q group of 130–139. Children of 140 to 170 I Q, however, are likely to become three or four years accelerated and to reach the eighth grade by the age of eleven or twelve years. Wherever children of the higher I Q groups are located, their work always presents a striking contrast with that of children of the 60, 70, or 80 I Q class who are several years their seniors.

CHAPTER X

SOME FACTS ABOUT FIFTY-NINE SUPERIOR CHILDREN[1]

Educational neglect of superior children. The attention of teachers is constantly being called to the large number of defectives among school children, and to the educational and social problems to which they give rise. For the intellectually superior, however, the ones upon whose preservation and right education the future of civilization most depends, no special provision is made. In the average school system their very existence, even, is ignored. Yet, as we have seen, they are just as numerous as the dull and mentally defective. The latter attract attention by their inability to do the work and by their maladjustment to school discipline. Children of superior ability are often submerged with the masses simply because they are not recognized.

Another thing that has blocked the educational path of the gifted child is the widespread belief that intellectual precocity is pathological, that exceptionally bright children are usually unhealthy and likely to become physical or mental wrecks if their intellectual interests are at all stimulated. Recently, however, the truth of the traditional belief has come more

[1] Written with the assistance of Margaret Hopwood Hubbard.

and more under suspicion. Such studies as have been made of gifted children have not disclosed the pathological symptoms popularly supposed to accompany exceptional intellectual ability. On the contrary, wherever the experiment has been tried of providing such children larger and richer opportunities the results have been surprisingly gratifying. When favored with extra promotions they make good in the higher grade without injury to health; when given the advantage of a broader and richer course of study their minds expand and take the wide swath as easily as they had taken the narrow one.

Instances of this kind coming to our attention from time to time led us some years ago to undertake the more or less systematic study of exceptionally superior children. With the help of Margaret Hopwood Hubbard and other Stanford University students, we have secured Binet tests of some eighty California children having an I Q above 135. All but a few of these tested 140 or above. Fifty-nine of the group were subjected to a rather careful study, which will be summarized briefly in this chapter.

Selection of subjects. The study was limited chiefly to children who tested 140 or above in order to secure subjects whose intelligence would be as far above average as that of typical feeble-minded children is below average. The fifty-nine subjects composed two groups, which will be designated as the Alameda Group and the Miscellaneous Group.

The Alameda Group included twenty-four subjects selected by systematic search throughout the public schools of Alameda, California. The method of selection was as follows: (1) The age-grade location was found for all the children in the grades below the high school; (2) the pupils were rated by their teachers for intelligence on a scale of five: very superior, superior, average, inferior, and very inferior; (3) all the children, who were under-age two or more years by the Ayres standard, and who were rated by their teachers as above average in intelligence, were provisionally selected for study; (4) the principals and teachers were asked to recommend others of exceptionally superior intelligence who could not qualify on the above rules.[1]

In this way seventy children of the five thousand enrolled in the schools of Alameda were provisionally selected and given a test with the Stanford-Binet

[1] The fifty-seven Alameda pupils who were tested but fell below the standard of brightness set for the study, included twenty-four boys and thirty-three girls, with I Q's as follows:

	Boys	Girls
130–135	9	8
125–129	4	8
120–124	2	4
115–119	1	6
110–114	3	4
105–109	1	3
100–104	2	0
95– 99	2	0
Total.	24	33

The two who tested below 100 were each one year over-age for their grade. The teacher's judgment was in error because age had not been taken into account.

scale. Of these, twenty-two were found to have an intelligence quotient of one hundred and thirty-seven or above. In addition, one subject of 135 I Q and one of 136 I Q were included for special reasons, making a total of twenty-four in the Alameda Group.

The Miscellaneous Group consisted of twenty-five children who had been located by the writer and by various Stanford students in the half-dozen years preceding the present study.

Supplementary data. The intelligence tests were used primarily to identify the superior children, and to measure their degree of superiority. Much more time was given to interviews with parents and teachers in the work of gathering items of information listed in an eight-page "information blank" for parents, and a somewhat shorter one for teachers. All of the homes were visited by Mrs. Hubbard except a few of the more distant ones. The interviews lasted usually one to three hours. Similar interviews were held with the child's teacher.

For the Alameda Group, duplicate office records were secured from the school principals, showing each child's school marks from the time of entering school. A number of educational measurements were also available for comparative purposes in the case of this group, including tests in addition, subtraction, multiplication, division, spelling, and arithmetical reasoning.

The information blank for teachers called for (1) data on school progress; (2) ratings of the quality of

the child's school work in each subject (usual scale of five); (3) indications of exceptional ability, and a statement as to whether the ability appeared to be special or general; (4) ratings on twenty mental, moral, and physical traits (scale of five used for each trait); (5) facts regarding play, reading, physical defects, nervousness, eccentricities, moral peculiarities, etc.

The information blank for parents called for data on (1) nationality, education, and occupation of parents; names and ages of all the children, with rating of each for intelligence; (2) ratings of the superior child on the same twenty traits which were rated by the teacher; (3) facts regarding walking, talking, dentition, nourishment in infancy, early growth, illness, etc.; (4) special data on adenoids, tonsils, eye and ear defects, headaches, digestive trouble, nervousness, timidity, amount and quality of sleep; (5) regularity of school attendance, attitude toward school, home study and reading, use of time after school, evenings and vacations, private instruction, etc.; (6) indications of superior ability, amount and kind of formal instruction in the home, vocational ambitions; (7) occupation, education, and ability of parents and grandparents, and data regarding uncles, aunts, cousins, and distinguished or defective relatives.

The traits which were rated both by parents and teachers were: studiousness, power to give sustained attention, persistence, social adaptability, leadership, initiative, evenness of temper, emotional self-control,

physical self-control, will power, cheerfulness, courage, sense of humor, obedience, conscientiousness, dependability, intellectual modesty (lack of vanity), unselfishness, general health, and general intelligence.

Intelligence quotients. The I Q's of the fifty-nine subjects were distributed as follows:

I Q	Boys	Girls
180–184	1	0
175–179	0	0
170–174	2	0
165–169	2	0
160–164	1	1
155–159	2	1
150–154	8	0
145–149	5	6
140–144	11	5
135–139	9	5
Total	41	18

The average I Q was 149.7 and the median 145. Only eighteen were as high as 150.[1]

[1] Since this study was completed, twenty-one other children have been located in California who test above 140 I Q, bringing the total number to eighty. As many of these as possible will be followed up from year to year until adult life. The twenty-one new cases not included in the present study are as follows:

Sex	Age	Grade	I Q	Sex	Age	Grade	I Q
G...	7–10	5	174	G...	10–2	5	148
G...	10–1	6	167	G...	7–6	1	148
B...	9–0	6	160	G...	4–4	Kgn	145
B...	8–8	5	157	B...	10–4	5	144
B...	11–4	8	156	B...	13–8	8	143
G...	3–6	0	154	G...	6–9	1	142
G...	6–8	0	151	G...	10–7	5	141
G...	9–5	5	151	B...	8–3	4	141
B...	4–0	0	150	B...	8–6		141
B...	10–5	6	146	B...	9–0		141
B...	6–3	1	144				

The lowest of our subjects is probably equaled or exceeded in brightness by not more than 1 child in 100; the highest by not more than 1 in 10,000 or 20,000. The highest I Q found in Alameda's enrollment of 5000 was 158. An I Q of 140 probably occurs with an average frequency of about 1 in 200, or one half of one per cent. It was found nineteen times in Alameda's enrollment of 5000, giving a ratio of a little less than one half of one per cent.

The average I Q for the children of the different ages was as follows:

Age	Number of Subjects	Average I Q
3	1	162
4	2	143
5	2	144.5
6	2	144
7	4	158
8	4	147
9	10	147.4
10	10	154.5
11	11	143.4
12	6	141.8
13	4	140
14	3	139.3

There were few subjects above the age of twelve years, because the search was confined almost entirely to the grades below the high school. The diminishing number below eight is explained by the difficulty teachers find in recognizing the superior child until he has attended school two or three years.

Of the fifty-nine, only eighteen were girls. Of the

eighteen testing 150 or above, only two were girls. The six highest were boys. During the progress of the work effort was made to ignore the possibility of sex differences. Of the seventy Alameda children selected for testing, more than half were girls.[1] Of the six girls testing above 145 I Q, all but one (a child of three years) have special ability in literary or artistic lines; the fields in which women have met the most pronounced success.

Age-grade location. Counting a child at-grade who is in the first grade between the ages of 6–6 and 7–5, in the second grade between the ages of 7–6 and 8–5, etc., we have the following distribution:

On basis of real age	Number	Per cent
Retarded	0	0
At grade	4	8.5
Advanced one year	14	29.8
Advanced two years	14	29.8
Advanced three years	9	19.2
Advanced four years	6	12.8

Judged by appearances, the above showing is remarkably good, for 61.8 per cent of the children are advanced two years or more. On the basis of *mental age,* however, the showing is strikingly different. Taking as our standard for the first grade the mental age of 6–6 to 7–5; for the second grade, mental age 7–6 to 8–5, etc., we have the following:

[1] Among the twenty-one superiors discovered after this study was made, there was a larger proportion of girls. One of these tested at 174.

On basis of mental age	Number	Per cent
Retarded five years..........	3	6.4
Retarded four years.........	10	21.3
Retarded three years.	12	25.5
Retarded two years.....	11	23.4
Retarded one year...........	8	17.0
At-grade..................	3	6.4
Advanced.................	0	0.0

Reckoning on the basis of actual age, we find an average acceleration of slightly more than two years; on the basis of mental age, an average retardation of about 2.6 years. The story is plainly told in Tables 36 and 37.

Chronological Age	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
6-7 to 7-6		1	1		1							
7-7 to 8-6				1	1							
8-7 to 9-6			1	2	4	2	2					
9-7 to 10-6					4	1	3	1				
10-7 to 11-6					1	2	4	2	1			
11-7 to 12-6							2	3				
12-7 to 13-6							1	2				
13-7 to 14-6								1	1		1	1

TABLE 36. SHOWING HOW SUPERIOR CHILDREN ARE ABOVE-GRADE ON THE BASIS OF CHRONOLOGICAL AGE

Teachers' ratings on quality of school work. The children were graded by their teachers on a scale of 1, 2, 3, 4, 5 (very superior, superior, average, inferior, and very inferior), in each of the school subjects. Each child's ratings in the several subjects were then

Mental Age	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
6·7 to 7·6												
7·7 to 8·6	1											
8·7 to 9·6		1										
9·7 to 10·6			1									
10·7 to 11·6												
11·7 to 12·6				2	2							
12·7 to 13·6			1		3	1	3					
13·7 to 14·6				1	2							
14·7 to 15·6					3	3	2	1				
15·7 to 16·6						1	3	2				
16·7 to 17·6						1	1	3	1			
17·7 to 18·6							2	2	1			
18·7 to 19·6								1			1	1

TABLE 37. SHOWING HOW SUPERIOR CHILDREN ARE BELOW-GRADE ON THE BASIS OF MENTAL AGE

averaged. The lowest average rating for any child was 2.91, or slightly better than "average" for all children. The highest was 1.16. The 461 ratings in the individual subjects were distributed as follows:

	Number	Per cent
1, very superior.............	227	49.3
2, superior......	133	28.8
3, average...	80	17.4
4, inferior..................	15	3.2
5, very inferior..............	6	1.3

The six ratings as low as 5 ("very inferior"), were distributed one each in music, spelling, manual train-

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ing, and language, and two in writing. The fifteen ratings of 4 ("inferior"), were distributed as follows: music three, spelling one, manual training two, drawing four, nature study one, writing four. There are no grades below 3 ("average"), in arithmetic, reading, history, geography, or deportment.

Although these children averaged about two years above grade, the ratings show that they were doing work of a decidedly superior quality. No wonder, since they were still located in grades below their mental levels. There is every reason to believe that they would continue to do superior work if they were promoted to the grades where they belong by mental age. Three had been so promoted, and their average school marks were 1.44, 2.08, and 2.55. Some of these children and also many other superiors whom we have tested have received promotion as a result of our recommendations, and we have yet to find a child who failed to make good.

Educational measurements. In connection with another investigation [1] all of the public school children of Alameda above the fourth grade were given the Courtis Arithmetic, Ayres Spelling, and Stone Reasoning tests. Eighteen of the twenty-four of Alameda were tested at the same time.

The tests revealed the following interesting facts:

1. The average scores of these superior children were higher than the average of any of the grades of

[1] By Mr. O. S. Hubbard.

the city with the exception of the high-eighth. In addition and spelling they even excel the high-eighth.

2. Of the six pupils in the low-fifth grade, four were above the eighth-grade median in addition and subtraction, two above the eighth-grade median in multiplication, two in spelling, and one in division.

3. One girl, aged 10-2, low-fifth grade, I Q 148, practically doubled the score of the high-eighth grade in addition, subtraction, and multiplication, and did considerably better than the eighth grade in division and spelling.

4. Two of the six pupils in the low-fifth grade made scores in arithmetical reasoning about 50 per cent higher than the city's median for the high-seventh grade.

5. In arithmetical reasoning, the subject which more than any other taxes the real mental ability of the pupils, the average score of the eighteen pupils was nearly two grades above the city average for the grades in which they were located.

Entering age and rate of advancement. Of the forty-nine subjects who had entered school and for whom data were available, seven entered at five years, twenty-four at six years, seventeen at seven years, and one at eight.

Of the seven children who started to school before six years, two skipped half of the first grade, two others the third, one the third and seventh, one the fourth, and one skipped two grades not designated.

Of the twenty-four who entered at six, four skipped the first grade, and seven others skipped half of the first grade. Of the seventeen entering at seven, only seven had attended the first grade, three having entered at once the second grade, five the third grade, one the fourth grade, and one the sixth grade.

It is often argued by teachers that children who are allowed to skip grades will later be handicapped by gaps in their knowledge. Our data show how little truth there is in this view. Nearly all of these children had skipped one or more grades, yet their school work was in most cases so superior as to suggest the desirability of additional promotions. Gaps in training are quickly filled. Of course, it would be better still if school children were so classified as to permit superiors to make maximum progress by continuous rapid speed without the necessity of skipping.

According to the statements of the parents, of the fifty who were in school, thirty had been allowed by their parents "to go their own pace." Thirteen had been mildly encouraged by their parents to make rapid progress and to excel in their school work. Seven had been purposely held back by the parents, — a few because of ill health, others in the belief that precocious mental development is something to be prevented as far as possible. In only two cases had there been any serious attempt in the way of intensive mind culture at an early age.[1] "Only" children would ordi-

[1] See children No. 34 and No. 39, chapter XI.

narily be expected to get more than their share of early instruction, but only seven of our fifty-nine cases were only children, and only two of these had an I Q above 143.

Age of learning to read. Learning to read considerably in advance of the normal age of six is a significant indication of superior ability. It is ordinarily not until the mental age of six years that children are able to learn to read as first-grade children are normally expected to do. The child of four years who learns to read as readily as the average child of six, will almost certainly test as high as 150. Several of the children who did not learn to read before six wanted to learn earlier, but were discouraged from doing so. The one who learned to read latest, between seven and eight, was said to have shown a desire to learn to read at four years.

Records were obtained for forty-nine, as follows:

Between	2 and 3 years,	1,	or	2	per cent
"	3 and 4 "	6	"	12	" "
	4 and 5	7	"	14	
	5 and 6	17	"	35	
	6 and 7	17	"	35	
	7 and 8	1		2	

Attitude toward school work. Both parents and teachers were questioned regarding the attitude toward school work. Of the fifty for whom data were secured, forty-three were said to like school very much, three fairly well, and three not particularly well.

One of these was a boy who was taught at home and did not enter school until the age of eight years, just after the death of his mother. He entered at once the sixth grade, the grade where he belonged by mental age; but the physical restraint in the class suited to twelve-year-olds, who had been in school six years, was naturally irksome to a young child who had always been acccustomed to unlimited freedom. The teachers did not understand his case and for a time he was very unhappy. He has since been taken from the public school, and placed in a private school where the discipline is less exacting. As a result, his attitude has undergone a radical change. There were equally good explanations in the other two cases.

All but five were very regular in school attendance, and these had missed time only because of illness. These five were rather delicate, yet in spite of illness and frequent absence they stood at the head of their classes.

Play and recreation. It is generally believed that children of exceptional intellectual ability are likely to have little interest in play. We sought information on this point from the teachers, rather than from the parents, in order to secure an impartial judgment based on a knowledge of many children. Of fifty-one for whom data were secured, thirty-eight were described by both teachers and parents as entirely normal in their play. Seven of the others were said to play less than average children, but to play normally when

they do play. Three had always been alone, and so preferred to play alone. One was too timid and reserved to mingle well with other children, and two others were said not to care to play with children of their own size. The abnormalities of play life do not appear to be more numerous or more serious than would be found in any group of children picked at random from the school population.

The data on out-of-school activities showed that our superiors were accustomed to spend their time after school like average children, playing, practicing music lessons, doing chores, running errands, etc. Saturdays were usually spent in the same way, with perhaps a dancing lesson, a hike, or a gymnasium period in addition. Many had gardens which they cared for, several had paper routes, others regular work in a store or elsewhere.

Twenty-eight were taking private instruction in music, twelve dancing lessons, and four language lessons. Only twenty were not receiving private instruction of some kind. The time devoted to private lessons, including practice, ranged from two to fourteen hours per week, the average being 5.3 hours.

The time devoted to home reading ranged from two to twenty-one hours per week, with an average of 7.6 hours. The books given as samples of the children's reading were classified as "good" or "mediocre." Needless to say, most fell in the former group. Among

the books and authors most frequently named were Stevenson, standard books of history, Dickens, Mark Twain, Cooper, geographical books, nature books, Conan Doyle, biographies, Eugene Field, Shakespeare, books of travel, Irving, Scott, *Ben Hur*, Jack London, *Little Lord Fauntleroy*, *Black Beauty*, *Arabian Nights*, *Alice in Wonderland*, *Pilgrim's Progress*, *Robinson Crusoe*, the *Odyssey*, the *Iliad*, Greek myths, *Book of Knowledge*, *Æsop's Fables*, *Bible Stories*, books on science and mechanics, and such magazines as *Youth's Companion*, *American Boy*, *Harper's*, *St. Nicholas*, and *Literary Digest*. Several had evidenced a strong liking for encyclopædias and dictionaries.

Trait ratings. Parent ratings on the twenty traits were secured for fifty children, and ratings by both parent and teacher for forty. It was taken for granted that the parent-ratings would be too high. On the contrary, the average for the parent-rating is lower than the average for the teacher-rating in the case of nineteen of the twenty traits. This is probably explained by the fact that the parent is compelled to take as a standard of comparison the child's brothers, sisters, cousins, or friends. To the extent that abilities are hereditary this would tend to give a higher standard than that employed by teachers, whose classes are composed of children of all grades of ability.

Table 38 shows the individual traits arranged in two rank orders; first according to teacher-ratings, then according to parent-ratings.

Trait	Average rating by teachers	Rank by teachers	Average rating by parents	Rank by parents
General intelligence	1.29	1	1.50	2
Sustained attention	1.44	2	1.70	3
Will power	1.50	3	1.81	5
Persistence	1.51	4	1.82	6
Dependability	1.56	5	1.92	7
Studiousness	1.58	6	1.74	4
Cheerfulness	1.61	8	2.00	9.5
Obedience	1.61	8	2.16	13
Conscientiousness	1.61	8	1.94	8
Courage	1.62	10	2.44	18
Unselfishness	1.73	11	1.42	1
Sense of humor	1.80	12	2.00	9.5
Evenness of temper	1.90	13.5	2.22	14
Intellectual modesty	1.90	13.5	2.24	15
Emotional self-control	1.94	15.5	2.70	20
Physical self-control	1.94	15.5	2.30	16
Initiative	2.06	17	2.08	11
General health	2.10	18	2.14	12
Social adaptability	2.24	19	2.38	17
Leadership	2.41	20	2.52	19

TABLE 38. SHOWING AGREEMENT BETWEEN THE TRAIT RATINGS BY TEACHERS AND PARENTS. (Correlation between the two rankings is .763)

The above ratings show that the parents and teachers agreed closely on the traits in which these children's superiority is most marked. General intelligence, sustained attention, will power, persistence, dependability, and studiousness, ranked high in the estimate of both parents and teachers; social adaptability and leadership lowest. Parents and teachers differed greatest in their ratings on the following:

Unselfishness	parents rate higher
Courage	teachers " "
Emotional self-control	teachers
Obedience	teachers

In studiousness, cheerfulness, and general intelligence, no child was graded below 2 by either teacher or parent. In power to give sustained attention, persistence, will power, conscientiousness, and dependability, only one child was marked lower than 3. In power to give sustained attention, persistence, and will power, the mark 4 was given to three children. In courage and sense of humor only three of the fifty children were marked 4, inferior. In initiative only two children were marked 4, and two 5. In unselfishness four children were marked 4. Five of the children were below average in evenness of temper, five in intellectual modesty, five in general health, seven in physical self-control, eight in emotional self-control, ten in social adaptability, and eleven in leadership. This is not far from the number we would expect to find below average in an ordinary group of children.

There are two reasons why a rather large number are graded below average in social adaptability and leadership: (1) in school most of them are associated with children who are older and whose greater physical maturity gives them an advantage over our young and inexperienced subjects in play activities. Six of the children rated 4 in social adaptability by the teacher were rated either 3 or 2 by the parent, which would indicate that among their own special friends and playmates they were average in these traits. (2) In a few instances the child of superior mental ability does not care to play. His preference for read-

ing and private lessons prevents him from becoming a leader or an important member in a social group. However, 13 of the 89 ratings in leadership were 1 (14.6 per cent), and 18 of the ratings in social adaptability (20.2 per cent). Five were rated 1 in social adaptability by both teacher and parent. The proportion of leaders is probably larger than would be found in a group of unselected children.

Moral traits. About half the twenty traits on which our subjects were rated might be classified as moral traits. "Obedience," "conscientiousness," "dependability," "unselfishness," "evenness of temper," and "will power" belong very definitely to this group. The average rating for the children as a group on these traits was as follows:

	Parent	Teacher
Obedience	2.16	1.51
Conscientiousness	1.94	1.61
Dependability	1.92	1.56
Unselfishness	1.42	1.73
Evenness of temper	2.22	1.90
Will power	1.81	1.50

In all of the moral traits except "unselfishness," the teachers' ratings were higher than those of parents. The children were rated higher by their teachers in deportment than in a majority of their studies. The average rating on deportment was 1.54, a record equaled by only three of the school studies, and not considerably exceeded by any.

These ratings would indicate that our subjects are

about as superior morally as they are intellectually. Additional information pointing in the same direction was obtained in response to the following request in the teacher's blank: "*Describe any moral faults or peculiarities such as disobedience, obstinacy, dishonesty, selfishness, inability to get on with others, unusual or abnormal sex interests, lack of balance, etc.*" Data were secured for fifty-three children. Of these, forty-six were said to have no moral faults or peculiarities worthy of mention. Of the remaining seven, one "takes pleasure in others' mistakes," one has "a rather bad disposition," one cries very easily, one is obstinate and "lacks will power to make himself do the things he does n't like" (certain of the school work), one girl is "very much interested in boys," and another girl is "shy" and "reticent." Practically all of these faults are such as would hardly be thought deserving of mention in the case of average children. They stand out in these children by contrast with their general superiority in other traits. There is only one child in the entire group who appeared to be seriously lacking along moral lines.[1] The typical superior is exceptionally lovable and charming, the kind of child one would like to adopt.

Health and physical traits. The average rating by parents on general health was 2.14; by teachers, 2.10. There were only two ratings of 5 ("very inferior") and two of 4 ("inferior"). On the other hand, there were twenty-eight ratings of 1 ("very superior").

[1] See child No. 33, chapter XI.

Only four were said to have defective vision, and only one defective hearing. Twenty-one had undergone operation for removal of adenoids, and two others were known to have more or less adenoid trouble. The record for tonsils was similar. The fact that approximately half of our superior children have had either adenoids or diseased tonsils suggests that these defects may not be as injurious to mental development as common opinion would have us believe.

One had chorea a few years ago, but has recovered. Two others had noticeable muscular twitchings. There were two stutterers in the group, both of whom at the time of the investigation were taking corrective lessons. There were no cases of abnormal fears. A part of the nervousness and restlessness occasionally mentioned was probably due to their not having enough school work to keep them busy. One boy, asked how he liked school, said he liked it in the morning but not in the afternoon, because by noon he always knew his lessons and then there was nothing to do! So much has been said about the nervous unbalance of precocious children that it is surprising to find over two thirds described as free from symptoms of this kind. The symptoms of most of the others indicated nothing serious. The proportion of stuttering and chorea was not far from that which is usually found for unselected children.

All but three of the children were said to sleep "perfectly." The average time of sleep for the children of

each age was found to be slightly greater than the Terman and Hocking averages for 2692 unselected school children.[1] There was no case of marked sleep deficiency.

Of the nine who were said to have occasional headaches, eight have them very seldom, not more than two or three times a year. One had long been subject to serious recurrent headaches.

Five were described as "not strong." One of these had always been sickly and at the age of eight years had only attended school one year. In that year, however, he did the work of the first three grades. Another of these has also had insecure health from birth. He did not enter school until the age of fourteen. Between the ages of six and twelve he had only one hour per day of private instruction, and in that time completed the work of the first eight grades. The other three of the five were apparently just not strong enough to endure serious physical strain or excitement. Only three were seriously handicapped by ill health, a record which would probably not be excelled by an equal number of school children picked at random.

Table 39 gives the ranges for age of walking and talking in comparison with those for Mead's two groups of normal and feeble-minded children.

[1] Terman, Lewis M., and Hocking, Adeline: "The Sleep of School Children; Its Distribution According to Age and Its Relation to Physical and Mental Efficiency"; *Journal of Educational Psychology* (1913), pp. 138–47; 199–208; 269–82. See also chapter xx of L. M. Terman's *Hygiene of the School Child* for a digest of this study.

	Range	Months Median	Average
Walking			
Mead's normal group*	11–30	13.54	14
Mead's feeble-minded group	12–72	21.60	24
Superior children group	9–18	13.00	13.4
Talking			
Mead's normal group	9–25	15.80	16
Mead's feeble-minded group	12–156	34.44	36
Superior children group	6–24	12.00	13

TABLE 39. AGE OF WALKING AND TALKING FOR SUPERIOR CHILDREN AS COMPARED WITH FEEBLE-MINDED AND NORMAL

* C. D. Mead: *The Relations of General Intelligence to Certain Mental and Physical Traits.* Teachers College, 1916; pp. 117.

The average age of learning to walk is a little more than half a month lower for our superiors than for Mead's normals, and nearly eleven months below the average for his feeble-minded. The difference in average age of learning to talk is greater, our superiors being three months ahead of Mead's normals and twenty-three months ahead of his feeble-minded.

Social status and heredity. We have classified our children according to the occupational status of the fathers, basing the classification upon Taussig's five occupational groups. Our subjects classify as follows:

Class 1	31, or 53	per cent
Class 2	22, or 37	" "
Class 3	6, or 10	
Class 4	0	
Class 5	0	

The results indicate that parents of a grade of intelligence low enough to keep them in the unskilled

or semi-skilled class are not likely to produce children of the grade of ability represented in this study. Of the seventeen subjects testing above 150 I Q, sixty-five per cent belonged to class 1, thirty-five per cent to class 2, and none to class 3. Several children of the two lower social groups were brought to our attention and were tested, but in no case was the I Q above 130. There is a tendency on the part of teachers to overestimate the intelligence of such children. The laborer's child of 130 I Q attracts about as much notice as a college professor's child testing at 150.

Information was sought regarding the child's brothers and sisters, parents, grandparents, cousins, uncles, aunts, and any other relatives of superior ability. Twenty-nine of the parents mentioned relatives whom they considered superior. Fifty-one superior uncles, thirty-seven superior aunts, and numerous cousins and remote relatives were mentioned. The large majority of the children had at least one grandparent known to be a superior. Among the more remote ancestors mentioned were Whistler, Edwin M. Stanton, Samuel Adams, Roger Williams, Colonel Crawford, Ralph Waldo Emerson, Stonewall Jackson, John Hancock, Hancock Jackson (a governor of Missouri), and Archbishop Tait. Others whose names were not given were designated as "a sculptor," "an artist," "a mechanical genius," "an eminent man in the South during the Civil War," "a president of a western college," "an inventor," and "an exceptional musician."

That the parents of our superior children were themselves superiors is further indicated by the extent of their education. Of the one hundred and twelve parents for whom data were available, fifty-two (46.4 per cent) were college graduates, and ninety-one (81.2 per cent) were graduates of a secondary school. In the population at large, the proportion of college graduates is probably not more than one fortieth as high, and the proportion of high-school graduates probably not more than one tenth as high, as that found for the parents of our superiors. Of the one hundred and twelve parents, sixteen (14.3 per cent) had done post-graduate work in a college or university.

Of the one hundred and seventy-two grandparents for whom data were secured, seventy-two (42.4 per cent) were graduates of a secondary school, while twenty-three (13.4 per cent) were graduates of a college or professional school. When we consider the limited opportunities for higher education at the time when these grandparents were youths, this record is hardly less remarkable than that of the parents. It is evident that most of these children had sprung from a decidedly superior stock.

Does the superiority tend to disappear? Exceptional brightness in children is often regarded as merely a matter of precocious development, the assumption being that the final level attained is ordinarily no higher than in the case of children who test at average-normal. This assumption finds no support in any of

the exact observations that have been made. Several studies have shown statistically that children who make exceptionally good records in the lower grades also as a rule make superior records in the high school, and the correlation between high-school grades and college grades has also been found to be positive and high.

We have had a number of superior children under observation for six to eight years, and in no case has there been any indication of a tendency toward deterioration to the level of average. If there were any constant tendency toward deterioration this should reveal itself in a decrease of the I Q with increase of age. However, re-tests of superiors show that the I Q is more likely to increase. Of our fifty-nine superiors, nineteen have been tested two or more times. The greatest loss in the re-tests was 10 points, while the greatest gain was 21 points. The central tendency was toward a gain of 2.08 points.[1] (See, for example, Figures 21 and 22, pp. 153 and 154.)

The results of the re-tests are corroborated by another line of evidence. One year after this study was made, the parents of the fifty-nine superiors were asked to re-rate the children on each of the twenty traits, and to give detailed information regarding any changes that had occurred in health, social adaptabil-

[1] However, as superiors of 130 I Q or above become adult the I Q rating fails to do them justice, as the highest I Q possible for an adult is 122 by the Stanford-Binet. Children of 140 I Q are not adequately measured above thirteen or fourteen years. (See p. 147.)

ity, quality of school marks, and ease with which school work was done. Replies were received for fifty-one children. For no child did the average rating on the twenty traits show any considerable change from that of the year before. The gains and losses were all slight, and almost exactly balanced each other. The results on health, school marks, ease of carrying school work, and social adaptability were as follows:

	Better	The same	Not so good
Health	3	44	4
School marks	5	40	6
Ease of school work	2	47	2
Social adaptability	9	42	0

On the whole, the amount of change appears well-nigh insignificant. Such changes as occurred in social adaptability, which constitutes the greatest problem for superiors, were all in the direction of improvement.

There is one circumstance which tends to make the superiority of bright children less apparent (but not less real) with increase of age. In the lower and middle grades all the children attend school, and the superior child in these grades is compared with the average for children in general. In the upper grades the children of inferior ability are rapidly eliminated, and here the superior is compared with "survivors" who compose a highly selected group. For this reason, the child who is correctly rated as "very superior" in the fifth grade may rank as merely "superior" in high school, and perhaps as only "average" in college. He

has not deteriorated; the average for his class has gone up.

Conclusions. The data which have been presented in this chapter justify the following tentative conclusions:

1. That intellectually superior children are apparently not below the average in general health;

2. That in the vast majority of cases their ability is general rather than special or one-sided;

3. That the superiority is especially marked in moral and personal traits;

4. That "queerness," play deficiency, and marked lack of social adaptability are the exception rather than the rule;

5. That while superior children are likely to be accelerated on the basis of chronological age, they are usually two or three grades retarded on the basis of mental age;

6. That their school work is such as to warrant promotion in most cases to a grade closely corresponding to the mental age;

7. That the superiority tends to show early in life, is little influenced by formal instruction, and is permanent;

8. That superior children usually come from superior families.

CHAPTER XI

CASE STUDIES OF FORTY-ONE SUPERIOR CHILDREN

THUS far our discussion of superior children has been impersonal and statistical. We have sought to find out what is true of such children in general, as regards their physical, mental, and moral traits and the influences which would explain them. This chapter will be devoted to brief descriptions of typical cases, in order that teachers may see in a concrete way what the superior child is like and sense the pedagogical implications of his presence in the school. The case studies to be presented could easily have been expanded to the length of a chapter for each child, and such detailed descriptions would be of the greatest interest. Our present purpose, however, permits only summary treatment of the most salient facts regarding a limited number of typical cases.

Most of the children to be described belong to the group discussed in the foregoing chapter. Apart from the results of the Binet test, the data to be set forth were in most cases furnished by teachers and parents. Their statements have been in part summarized and in part quoted, though usually with abbreviations and with omissions of matters of secondary interest. The "trait rating" mentioned is always the average rating given (by teacher or parent) on the twenty

physical and mental traits named on p. 182. It will be remembered that in these ratings 1 is "very superior," 2 "superior," 3 "average," 4 "inferior," and 5 "very inferior." It will be noted that in no case does the average rating of a child on the twenty traits, either by parent or teacher, fall as low as 3.

No. 1. *Boy: E. M.*[1] Illustrating exceptionally rapid school progress and unusual will power.

First test: age 6–11; mental age 10–0; I Q 145; not in school.

Second test: age 7–10½; mental age 13–2; I Q 167; fourth grade.

Third test: age 10–0; mental age 16–7; I Q 166; high-eighth grade.

In the second examination (age 7–10) E. passed the induction test,[2] the arithmetical reasoning and the clock test in year 14, the code test and six digits backward in Average Adult, and repeated eight digits direct order and seven digits reverse order in Superior Adult.

When E. was tested at the age of 6–11 and earned an I Q above 140, the prediction was made that he would be able to enter high school at the age of 11

[1] See brief description of E. M. at age of eight, in Terman, Lewis M., *The Measurement of Intelligence*, p. 100.

[2] These different tests are all described at length in Terman's *The Measurement of Intelligence,* which see.

years, or possibly at the age of 10. He did so at the age of 10–5, having completed the work of eight grades in three years. Practically every mark, except in handwork, has been perfect. He entered the first grade at 7½ years. On the first day of school he was placed in the first grade, but within an hour he was promoted to the second grade, by noon to the third; and to the fourth before the end of the school day. His teacher had studied exceptional children and was able to recognize superior ability. Under the average teacher it would probably have taken E. two years instead of one day to reach the fourth grade.

E.'s father is a professional man: the mother a university graduate and formerly a teacher. The maternal grandmother was a university graduate and a school principal of more than ordinary ability in mathematics. E.'s ability in mathematics is also marked.

Parents' notes. Health record good. Ability is fairly general, but somewhat special. More marked along mathematical and scientific lines than others. Wonderfully adept at arranging and classifying facts. When between three and four years of age could add long numbers. Learned to read at the age of 5 by following his mother around and asking the names of letters, and soon afterward surprised his parents by reading fluently out of a primer. Has had no formal home instruction, but parents have been careful to answer all his questions. Does little studying at home and reads only about seven hours per week. Spends

his spare time in play, delivering papers, etc. Exceptionally dependable and takes life seriously. Helps his father a great deal in the office, and can be safely entrusted with important responsibilities in the details of office work. Has sometimes to be kept out of such work because of worrying about getting it through promptly and accurately. Average parent rating on traits, 2.05.

Later report, age 10, eighth grade. Health excellent. Reads more and does less statistics. Work in manual training still mediocre. School marks excellent, but not quite as good as formerly. "He seems to have his hands full for the first time in his life." Growing more adaptable and agreeable. Elected to various offices in school. Parents' rating on traits at this time, 2.08, about the same as before.

Teacher's notes. Ability not altogether even. Spelling and arithmetic perfect. At the age of 8 did the work of the eighth grade in mental arithmetic tests. Has a wonderful memory for facts, but does not often ask for reasons or explanations. "Ability above average in all lines, but especially so in statistics, facts, or anything capable of formal array. Can tell the study and recitation schedule of every class, and remembers the lesson assignment for all the other pupils; can tell who missed certain words yesterday in any class." Rather enjoys the mistakes of others. Exceptionally calm and quiet. Teacher's average rating on traits, 2.10.

One of the most interesting things about E. is the fact that his school record has been better than that of many other superior children testing fully as high. To one who knows him the reason is clear. His will power and determination are about as superior as his intelligence. He will not allow any one to excel him in mental work. In manual training, however, his work is inferior even to that of the average child of his age.

No. 2. Boy: H. B. Illustrating extreme retardation in school, although nearly as bright as No. 1.

Age 8–7; mental age 12–10; I Q 150; low-third grade.

Vocabulary score, 44. Passed the box test and repeated six digits backward in Average Adult.

With a mental age of nearly 13 years, H. is in the grade which corresponds to his actual age of 8½. His mother wants him advanced because, she says, "He gets so tired of school when he finds it so easy to keep ahead of his class." However, he has only been in school one year and has been allowed to pass through two grades in five months.

Parents' notes. Was seriously ill for some time in his first year. Health now good, except for occasional digestive trouble. Slightly nervous.

At the age of 5½ read like an average pupil in the second grade. At 7 read everything from children's books to newspapers and magazines, reading every

word and understanding the text. At 5 years read numbers to the thousands. At 5½ counted to a thousand. No special instruction beyond answering his questions in a simple, truthful and thorough manner. Has unusual ability in oral expression. Average parent rating on traits, 2.00.

Later, age 9½, in the high-fourth grade. Health good. Greatly interested in the progress of the war, inventions, conversation, etc. Doing well in piano lessons. He ranks with one other pupil as the best in his class. No home work. At ease in any group and evidently a natural leader. Average teacher rating on traits at this time, 1.20, or considerably better than before.

Teacher's notes. "He is very musical. His mental ability, however, is general. Says he expects to 'know lots of things.' Would read continually, if permitted."

No. 3. *Boy : A. W.* Illustrating the value of mental tests in school grading.

Age 5–8; mental age 7–6; I Q 132; not in school.
Age 6–8; mental age 8–8; I Q 130; second grade.

At the age of 5–8 passed all but the vocabulary test in year 8, arranged the weights in year 9, and passed the three-word test in year 10.

As a result of the test the father, a superintendent of schools, was urged to send the boy to school at once and to see whether he would not be able to complete

the first two grades in one year. A few months later the father wrote as follows: "A. is learning to read very rapidly. In four weeks he has learned to read the entire primer of 137 pages. Four weeks ago he could not read a line." A year later, at the age of 6–8, A. was leading his class in the second grade, and at the age of 7 years was doing splendid work in the low-third grade. The father writes at this time, "A. seems more interested now than ever. School marks excellent and the work perfectly easy."

It is altogether probable that but for the test and for the fact that the father was superintendent of schools, and therefore able to secure extra promotions, A. would have gone through school without ever having an opportunity to do work commensurate with his ability.

No. 4. *Boy: S. S.* Brother of R. S., No. 5. Illustrating exceptional mental balance. Later development predicted.

Age 4–7; mental age 6–8; I Q 145.
Age 5–10; mental age 8–9; I Q 150.
Age 7–0; mental age 10–8; I Q 153.

At the time of the third test S. had not yet started to school. Vocabulary score at the age of 7, 28 words.[1] At this time passed four tests in year 12, including abstract words, ball and field, fables and similarities.

[1] Indicating a total vocabulary of approximately 5000 words.

In the induction test, year 14, announced the rule governing number of holes before the end of the experiment, but was unable to double 16.

The following notation appears on the record for the first test, when S. was $4\frac{1}{2}$ years old: "By 8 years S. will test $11\frac{1}{2}$." His test at the age of 7 gave him a mental age of 10–8, so it appears the prediction will be more than fulfilled.

Parents' notes. No serious illness except the ordinary children's diseases. Has always shown remarkable power of reasoning. Has had little home instruction, but is reading in the second reader (age 7). Is omnivorous as to the books he wants read to him. French lessons twice a week and some instruction on the piano. Allowed to go his own pace. "However, we have always answered his questions truthfully and fully. We have always allowed him to take the initiative, have never suggested his memorizing anything, have never forced anything on his attention." Early ambition was to be a railroad engineer. Recently he cherishes the hope of becoming a reformer! Average parent rating on traits, 2.00.

S. is a most lovable boy, quiet and retiring yet not bashful. His bearing is one of very modest dignity. He is perfectly unspoiled. Father a college professor of journalistic experience; mother a college graduate of unusual ability and marked musical talent. Several relatives of superior ability. S. developed much earlier

in childhood than his sister (who tests at 147) and gave somewhat more evidence of superior ability.

No. 5. Girl: R. S. Sister of S. S., No. 4. Artistic ability and marked emotionality. Underrated by parents.

Age 4–10; mental age 7–1; I Q 147; not in school.

Wonderfully responsive. Full of life and the picture of health. Talked most charmingly and with utter lack of self-consciousness all the way from her home to the laboratory where she was to be tested. Although less than 5 years old, she passed the test of arranging weights in year 9. The parents were greatly surprised that her I Q equaled that of her brother. They had probably not made sufficient allowance for the difference in age.

Parents' notes. R.'s aptitude is described by her parents as being in the direction of artistic expression. "She sings wonderfully true to time and key and dances with natural grace. She has acquired a sureness of stroke in drawing which an equal amount of Montessori training never gave her brother. She has natural dramatic ability, but lacks the development of abstract thinking which characterized her brother. She has never been asked to learn anything, although her questions have always been answered fully and truthfully. However, she has never asked as many or varied questions as her brother, from whom she has

learned most of what she knows." Average parent rating on traits, 2.85. Obedience and emotional self-control were both rated 5. R. is said to be emotional, impatient, and inclined to fly into fits of screaming if things displease her. Play life normal.

No. 6. *Boy: J. S.*[1] Lovable disposition. Indications of literary ability.

Age 8–2; mental age 11–4; I Q 138; high-fourth grade.
Age 11–0; mental age 15–2; I Q 136; high-seventh grade.
Age 12–3; mental age 17–7; I Q 144; high school.

J.'s I Q is by no means as high as many others we have found, but he has such a winning personality, charming disposition, and uniform ability that we consider him one of our most promising superiors.

The father was a man of superior ability, and the mother had been secretary of a large business firm. Both parents died several years ago, and J. has been reared by his aunt. On his twelfth birthday J. handed his aunt a beautiful letter which he had written, on his own initiative, to express his appreciation of the way she had cared for him. This is typical of his loving and lovable disposition.

[1] See brief description of J. S. at the age of 8 years, in *The Measurement of Intelligence,* Lewis M. Terman.

J.'s unusual talent for writing is shown by the following poems written before his eighth birthday. They are reproduced without change of spelling or punctuation:

Christmas

Hurrah for Christmas
And all it's joys
That come that day
For girls and boys.

Flowers

Flowers in the garden.
That is all you see
Who likes them best?
That's the honey bee.

My mother's busy

My mother is very busy today
And all I have to do is play.
If I only knew what she had to do
I'd like to help her, would n't you?

What a trouble washing day;
It seems my mother can never play.
I wonder if she'll get tired out
From walking, walking all about.

Here is Sunday, — resting day;
That's the best thing I can say.
We go to church and pray and pray, —
That's the hardest thing I say.

Before the age of eight J. amused himself by writing fables to which he always attached a correct moral.[1] The following is a sample:

A Fable — The Selfish Boy and the Poor Girl

Once there was a rich boy in a city and he went into a candy store and bought some candy. When he came out he still had a lot of money. While he was walking down the street he met a little girl selling shoe laces. He just kept on eating candy and did not buy anything from her or even offer her a piece of candy.

About a month later the rich boy's house was robbed and this little girl was getting a lot of money. The boy now had to go around selling and he met the girl many times, but she never helped him because when she had been poor he did not help her.

Moral: Those you do not help will not help you.

No. 7. Boy: T. B. All-round ability, with special interest in medicine. Musical family.

Age 10–5; mental age 15–2; I Q 146; sixth grade.

Vocabulary score 64, which is practically median for mental age 16. Passed the ingenuity test in Superior Adult.

Father French, mother American. A great grand-uncle was Meyerbeer, the French composer. Another uncle is a locally well-known violinist and composer.

Parents' notes. T. has always been perfectly healthy

[1] It will be remembered that the Stanford-Binet test of fable interpretation brings an average of only two successes for five fables at the age of twelve, and four successes for five fables at the Average Adult level.

except for slight nervousness. Somewhat myopic. Learned to talk at 7 months. School work easy; does little home work except in the practice of music, of which he is very fond. Shows a remarkable interest in medical science. All his childish games and all his reading have tended in this direction almost from the time he could talk. "Have tried to hold him back because of his tender age and temperament." Although healthy, he has always been high strung. Chief indications of superiority, his passionate desire to learn and his obsession for medicine.

Teacher's notes. School work excellent, except drawing. "T. expresses his thoughts on any subject in a marvelous way for a boy of his age. He is capable both in his oral and written work. Very studious and interested in his work. His power of attention sometimes seems lacking, but when I have called it to his attention on certain occasions he has said, 'I was only day-dreaming.'" Very adaptable socially. Absolutely unspoiled. Very conscientious and unassuming. Enjoys reading medical works, especially in the surgical line. Reads from a medical encyclopædia. Also studies electricity and likes to experiment. Very strong sense of truth and marked straight-forwardness.

T. is probably one of the most promising of our superiors. His interest in medicine was evident in the sixty-word test, in which he gave the names of numerous bones, muscles, and other organs of the body. We

have here not a case of one-sided ability, but a mind of very superior general ability focussed upon a special subject.

No. 8. *Boy: P. T.* Ordinary parents and dull brother.

Age 11–11; mental age 17–7; I Q 148; low-eighth grade.

This boy is specially interesting because of the contrast with his brother, who at the age of 6–10 tests at mental age 5–8; I Q 83. The parents say the two children are absolutely unlike, and the verdict of the tests agrees with this opinion.

The father is a carpenter. Neither parent has had more than a common school education, but the mother is somewhat above the average in intelligence. A distant relative of the mother was a high official in the Methodist Episcopal Church, and a relative of the father was an archbishop of Scotland.

Parents' notes. P. shows unusual ability in all of his school work and also in music. He succeeds in everything he undertakes. When he was 22 months old he knew the names of the important buildings in San Francisco and could point them out on a photograph of the city. Was never taught at home beyond the alphabet. Health record good. Desires to become a mechanical engineer. The younger brother expects to be a farmer. Average parent rating on traits, 1.60.

One year later, age 13. Excellent record continued in every respect. This time the mother rates the child 1 on every trait. She is probably realizing more and more the contrast with the younger brother.

Teacher's notes. All-round ability. "A. is a great reader and a most satisfactory pupil." Teacher's rating was 1 on all but two of the traits.

No. 9 *and No.* 10. *C. D. and L. D. Brother and sister.* Exceptional children of ordinary parents.

C. Age 14–6; mental age 19–0; I Q 131; third year high school.

L. Age 10; mental age 13–8; I Q 137; high-fifth grade.

C. made the remarkable vocabulary score of 82 words, which equals that of the average university senior. He has reached a stage of development where the Stanford-Binet falls short of being an adequate measure.

A brother of C. and L. is in the seventh grade at the age of 11, and a sister is in the second grade at the age of 7. Neither has been tested, but both are said to be as bright as C. and L.

In one respect this is the most interesting family of children of whom we have record. The father is a barber, the mother was a tailoress before marriage, and not a single known relative has had more than a common school education or intelligence above the ordinary. Each of the four children belongs to a grade

of superiority not encountered oftener, on an average, than once among one hundred children.

Parents' notes. C.'s health is perfect except for myopia and slight headaches. Entered second grade at the age of 6 and shortly afterwards skipped to third. Spends all his spare time in reading. Learned the alphabet at 2 years and could read books and newspapers at 3. Special ability in mathematics. No special instruction, but has been encouraged.

L. is more sociable, talkative, and active than C. Her health is very good and her school work gives her no trouble. She is less studious than C. but gave in childhood similar indications of superiority.

Teacher's notes. The teacher says regarding C.'s high standing in class, "I would cite as evidence of unusual talent his answers to questions proposed during the lesson, which are almost invariably in a single short sentence covering completely the ground." Social adaptability inferior. Is pensive, very shy, and retiring in a crowd of boys. Remarkable power of concentration.

L. is described by her teacher as exceptionally quick and accurate in her work and alert to everything.

No. 11. *Boy: B. F.*[1] Remarkable all-round ability, which was greatly underestimated by the parents.

[1] See brief description of B. F. at the age of 8 years, in Terman, Lewis M., *The Measurement of Intelligence*, p. 102. At that time B. F. was the brightest child in the Stanford records.

First test: age 7–8; mental age 12–4; I Q 161; high-third grade. Vocabulary score in this test was 40 (median for 12 years). The induction test in year 14 and the box test in Average Adult were both passed.

Second test: age 9–4; mental age 15–7; I Q 167; low-sixth grade. In the second test the vocabulary score was 56. The fables, box and code tests of Average Adult, and the paper-cutting test and abstract passages of Superior Adult were passed.

B.'s father is an able minister, and the mother is a woman of exceptional intellect and personal qualities. The following statement by the parents illustrate how the superior child in a superior home is likely to be underrated because of the high standard by which he is judged: "His development has seemed to us quite normal and even. We had not thought of him as much above the average in intelligence." (Mother.) "Really Mrs. F. and I think that some mistake has probably been made in the observations upon which your rating is based. While B. is an alert, good and thoroughly satisfactory boy, we have never thought of him as considerably above the average in mentality. We have tried to be good parents to him, provoking inquiry, answering questions and giving him opportunity for a variety of experiences that would furnish raw material for his ideas." (Father.)

Nevertheless, B. has a grade of intelligence which is

probably not equaled by more than one child in five thousand.

Parents' notes. B. has never been seriously ill, but there is a slight tendency to stutter when he is excited. Learned to read at 5. At 7 read *Hiawatha* and committed 150 lines of the poem to memory. Does no home study and reads only about a half hour per day. Spends hours after school in outdoor play, marbles, football, and base ball; also practices on the piano. Has an unusual fund of information in history and current events. Catches impressions easily. Many interests. Allowed to go his own pace in school, and has had no formal instruction in the home. Wants to go through college and become a minister. Takes his place well among other children without being a leader.

Two years later, age 11. The mother writes that notwithstanding a change of schools the teacher considers B. ready for the eighth grade. School work easier than ever. Shows a growing interest in world problems. Average parent rating on traits at this time, 1.75.

Teacher's notes. Unusual ability in reasoning and an exceptional fund of general information. Also considerable ability in music. In two and a half years has almost completed six grades. Remarkably attractive and alert. Not particularly handsome, rather delicate in appearance, but vigorous in his play and a favorite with the children who congregate in his

yard. Rated 1 by the teacher on every one of the twenty traits, the only one of our superior children with whom this occurs.

At the time of the first test B. was above 12 years in mentality, but was in the high-third grade. On the showing made in the test we urged the father to try to secure an extra promotion. This was done, and the results fully justified the recommendation. In all, B. has skipped four half-grades and still continues to secure perfect marks.

No. 12. *Boy: L. M.* Brother of No. 13. Underestimated by parents. Morally superior.

Age 6–8½; mental age 9–5; I Q 140; first grade.
Age 9–6; mental age 15–1; I Q 159; fifth grade.

At 9–6 L. passed the code and box tests of Average Adult; also repeated 8 digits and did the ingenuity problem in Superior Adult.

There are five children in this family, all above average. One earned "A" marks all through high school and graduated at 17, winning a college scholarship. Father a minister of exceptional ability.

Parents' notes. Average parent rating on traits, 3.21. Health good. First showed unusual ability in arithmetic at the age of 3 years. Has been allowed to go his own pace, except as older sister taught him in playing school. L. has a way of making for what he wants regardless of obstacles.

One year later, age $10\frac{1}{2}$. Not robust; out of school because of unsatisfactory general health. "Brain and ambition out of proportion to strength, but is improving. His interests take in the whole world; — prohibition, Red Cross, Y.M.C.A., Boy Scouts, Athletics. Gives morality talks to any one he thinks in need of them. Walks miles distributing literature for all the 'drives.'"

Has a circulating library of about fifty volumes in constant use among the neighbor children, for which he keeps the accounts carefully and systematically. Remarkable in his choice of books; "has never even by chance brought home from the public library an undesirable book." School marks continue good. School work rather laborious, as he has little patience with details and makes careless mistakes. Average rating on traits now, 2.20, considerably higher than before.

Teacher's notes. All-round ability. Without self-consciousness and speaks well before the class.

No. 13. *Girl: C. M.* Sister of No. 12. Early indications of superior ability.

Age 7–6; mental age 11–10; I Q 158; fifth grade.
Passed the box test in Average Adult.

Parents' notes. Average parent rating 1.95. Health perfect. Has abnormal physical strength. "Before we knew it, soon after her sixth birthday, she read and

enjoyed the *Courtship of Miles Standish*, saying she thought it was 'such beautiful language.'" About the same time she wrote little two-page stories. Intelligence was also evident in clearness of answers in conversation, fine reasoning powers and right conclusions. Superiority noted at 4 years. Allowed to go her own pace. No home instruction except what she received from a very bright older sister who played school and gave her good instruction in drawing, reading, and numbers. Reads good poetry, the Bible, and classics, all of which she thoroughly understands and enjoys.

One year later, age 8½. Robust health. Highest school marks. Leadership marked. Average rating now, 1.50.

No. 14. *Boy: J. C.* A case of exceptional all-round mental precocity. A leader.

Age 11–4; mental age 17–9; I Q 156; seventh grade.

Although only a little more than 11 years old, J.'s vocabulary score was 75. He passed all but the paper-cutting and ingenuity tests in the Superior Adult group. As a result of the test he was promoted to the eighth grade.

Mother's notes. J. could talk before he was a year old, could stand at seven months and run at ten months. He read *Ivanhoe* at the age of 7. "Has seemed always to read and study. Has always been

a big boy to me." Of quiet disposition, without a touch of vanity. Has the dictionary habit, and is an omnivorous reader. Spends much time with encyclopædias. Excellent health. Has become interested, in athletics and other boyish matters. Masters his school work with apparent ease. Adapts himself to any person or crowd. Leads in educational games and is often chosen as leader. Even temper, sympathetic, considerate, generous, and kind hearted. Expects to go to college and take up scientific agriculture. Average parent rating **1.65.**

No. 15. *Boy: G. G.* Illustrating all-round superiority and marked precocity.

Age 12–0; mental age 16–8; I Q 139; eighth grade.

Teacher's notes. "A problem is never given that G. will not try. He always wants to know why, and will stick to his view until it is proved incorrect." Has ambition to succeed and be the first in his class. Sense of humor far beyond his years. Has a splendid command of language. His ability is general. Has some trouble getting on with the large boys because he still has childish ideas about some things; but takes things good naturedly and goes right on. "He is one of the best all-round superior children I have ever had in eighteen years of experience as a teacher." Average teacher rating on traits, 2.10.

Parents' notes. Health good; sleeps ten hours.

Reads Shakespeare, the *Book of Knowledge*, and nature books. Some musical ability. Specially fond of arithmetic and history. Memory exceptionally good. "At 3 years he loved to be read to, and could quote many nursery rhymes. At 4 he quoted several long stories word for word. At 5 he could print the alphabet, and insisted on being told how to spell words." No formal instruction before going to school. Since then he has gone his own pace. His questions have been answered clearly, and current events have been discussed in his presence. Is much interested in machinery. Understands fairly well motor-car construction.

One year later, age 13. Did not attend school last year because of an enlarged cervical gland which necessitated an operation. Health is good now. Greater interest in outside activities and athletics. Plays piano and cornet. Does his school work with ease. School adaptability improved. Is less nervous than formerly. Average parent rating, 2.10.

No. 16. *Girl: C. G.* Illustrating marked leadership and social adaptability.

Age 13–9; mental age 19–1; I Q 139; fourth year of high school.

C. lives in a city in the northern part of California. When we visited there and inquired for the brightest pupil in the city schools, the superintendent and

teachers mentioned C. without hesitation. Arrangements were made with the mother for testing her the following day. On the next day, however, C. had come down with an attack of measles and had a high fever. Notwithstanding this she wanted to go on with the test, which was given, with the result noted above. All the tests in the Stanford-Binet were passed with one exception, the box test in Average Adult.

C. taught herself to read when she was 31 months old. She started to school at the age of 6, and in seven and a half years had completed the work of twelve grades. Throughout she has led her classes. She is also a leader in all kinds of school activities, such as dramatics and class activities. She is a favorite both with fellow pupils and teachers. Physically she is more than ordinarily mature for her age. Her health has always been perfect. All her extra promotions have been given on the initiative of her teachers, the parents having always urged them to hold her back. Expects to be a lawyer.

C.'s sister graduated from university at 21 and was president of the student body. Later did post-graduate work. Another sister of 11½ years is in the low-eighth grade. A brother graduated from university at 20, and at 24 is holding a responsible business position. It is doubtless this high standard of ability in the home which accounts for the average parent rating on traits of 2.45, or only a little above "average."

No. 17. *Girl: K. C.* Exceptional personal charm. Indications of musical ability. A social favorite.

Age 3–2; mental age 4–8; I Q 144; not in school.
Age 5–2; mental age 7–4; I Q 142; not in school.
Age 6–4; mental age 8–10; I Q 140; first grade.

At the age of 5 K. counted backward from 20 to 1, gave definitions superior to use, and arranged the five weights. This test was given as a demonstration test before a dozen university students. K. liked the test so well that when it was over she did not want to leave.

One of the most charming little girls we have ever known. Absolutely unspoiled and lacking in any appearance of self-consciousness. She sang beautifully at the age of 3. Learned to name the colors, the days of the week and the months of the year on her own initiative and simply by asking questions.

Her father is a college professor. Both father and mother have several relatives of superior ability.

Parents' notes. Nothing unusual in early childhood except that her development has been somewhat rapid. She spoke a few words at ten months. Play life and social relations perfectly normal. A favorite and takes the lead in play. Exceptional musical ability and interest in colors. Alive to everything around her. Seems to want to know everything she hears talked about. Allowed to go her own pace, but information she asks for is never withheld. No formal instruction. Average parent rating, 2.00.

A year later K.'s health remains perfect, her interests are broadening and she is developing marked traits of leadership. Average parent rating at this time, 1.95.

No. 18. *Boy: S. D.* Splendid heredity. All-round ability and exceptional courage.

Age 7–5; mental age 10–10; I Q 146; third grade.

Second test: age 10–0; mental age 15–1; I Q 151; seventh grade.

The great-grandfather of S. was a chum of Abraham Lincoln and a candidate for United States Senator when he died, at the age of 35. The brother of this relative was a noted attorney. Father of S. is also an attorney, the mother a high-school teacher. A cousin on the mother's side is in the third year of high school at the age of 13 years. Several uncles of the mother were political leaders in the early history of Kentucky.

Teacher's notes. "I cannot say that S. has unusual talent of any special kind; he simply has a big mind in a big body. Ability is all-round superior." Average teacher rating on traits, 1.5, one of the highest ratings we have found.

Parents' notes. Health has always been perfect. Spoke a few words at 6 months. Entered the third grade at 7 years, and in two and a half years covered four and a half grades. Learned to read at the age

of 5. Does no regular study at home, but reads about half an hour each evening. Holidays spent in play, chores, fishing, and swimming. No formal instruction in childhood, but has been encouraged to stand at the head of his class. Average parent rating on traits, 1.85.

One year later, age 11–3. In the eighth grade, doing excellent work. Health good and development satisfactory in every way. Average parent rating at this time, 2.10. In rating courage the mother made the following remark: "All I can say about this is that S. when only 10 years old entered a burning house and brought out a baby, then reëntered and dragged out a wooden chest, and was ready to enter again when I had to hold him outside by force while the roof fell in."

No. 19. *Boy: R. V.* Early evidence of superiority. Natural interest in teaching.

Age 11–7; mental age 16–6; I Q 142; high-seventh grade.

Father a carpenter, with only a common school education. The mother a teacher before marriage. There are seven children, all of whom are superior.

Parents' notes. Health good except for an attack of acute rheumatism when he was 6 years old. Taught himself to read with the aid of a telephone book and calendar. Loves to teach. Has prepared several

children in the neighborhood for school. Superiority first evident at the age of 4. No instruction in childhood. "We wanted him to be outdoors and build up a good constitution." R. is quite up to the times in politics and war. Joins in the discussions on these topics. Signed the prohibition pledge at Sunday School and will not eat anything that has brandy in it. Ambition to write books. Average parent rating on traits, 1.90.

One year later, age 12½. Health good. School work very good. Leads among the boys in the neighborhood. Rather impatient and quick to anger, but soon recovers his poise. Parent rating at this time, 2.00.

Teacher. Average rating on traits, 1.59.

No. 20. *Boy: F. H.* One of our brightest children. All-round ability and very exceptional vocabulary.

Age 10–5; mental age 17–11; I Q 172; high-fifth grade.

Vocabulary score was 78 (14,000 words). This is almost equal to that of the average college student. Every test was passed in year 14, four out of the six in Average Adult, and five out of the six in Superior Adult. Every fable was perfectly interpreted.

Father a physician. Mother had only a common school education. Several superior relatives, a brother testing at 137.

Parents' notes. Entered the first grade at 5. Ability general. Superiority first evidenced at the age of 6 by his unusual interest in school work and by his original thinking. Has never been specially stimulated. Allowed to go his own pace "because that was fast enough." Average rating by parents, 1.75.

The teacher describes F. as having wonderful all-round ability and gives him an average rating of 1.30.

No. 21 *and No.* 22. *J. J. and B. J.* Italian children, brother and sister.

Boy: J. Age 9–0; mental age 12–7; I Q 140.
Girl: B. Age 6–8; mental age 10–1; I Q 151.

Here are two Italian children, the only ones of this nationality we have discovered testing anything like this high. Both are exceptionally attractive, polished yet natural in manners, beautiful and unspoiled. J. is described as more studiously inclined than B. and as being also more sensitive. Mother was inclined to believe the boy the brighter of the two, but the test places the girl slightly above. Both parents are well educated.

Three of the four grandparents are described in such terms as "extremely bright," "keen reader," "interested in history and international affairs," etc. The paternal grandfather was an "able linguist and scientist," a member of the Royal Geographic Society, and

a talented singer. Many relatives of culture and learning on both sides.

J. did not learn to talk until he was 2 years old. He is somewhat emotional, but general health is good. Sleeps $11\frac{1}{2}$ hours. Learned to read at the age of 5 years. At this age about one hour daily was given to instruction in reading and writing. "We never forced him, but always let him know there is a premium on fine scholarship." At the age of 6 was tutored about $2\frac{1}{2}$ hours daily. Has never attended school. Specially talented in music. Plays well and has a keen sense of harmony.

B. learned to read at the age of $5\frac{1}{2}$, and was able to read the fourth reader at the age of 6–2. "Superiority shown in her keen observation and in her understanding of human character. This was noticeable at the age of 4, or even younger." Like her brother, has been allowed to go her own pace.

No. 23. *Girl: M. S.* A typical illustration of the ease with which superior children learn without instruction.

Age 8–3; mental age 12–1; I Q 146; fifth grade.

Passed the fable test and repeated six digits backwards in Average Adult.

Mother's notes. M. learned to read without any instruction at the age of 3 years. Read signs and advertisements and names on food packages which were frequently seen about the house. At 6 years read bet-

ter and more naturally than since listening to other children at school. Has dramatic ability. Shows remarkable grasp of all instruction and is good in execution. Makes progress two or three times as rapidly as ordinary children. "M. has just 'growed up' as I have had continual illness in the home and have been unable to give her the attention she should have had. I held her back from skipping the fifth grade because I felt that physical perfection was the first consideration." Health always good. Wishes to become a teacher or to take up dramatics. Mother believes she could also succeed in business.

Later, age 9½, in sixth grade. Health and school work A-1. "A born leader, but a little too dogmatic and positive to be socially popular."

No. 24. *Girl: M. S.* General ability, combined with talent in art. Exceptional heredity.

Age 9–1; mental age 12–10; I Q 141; low-fifth grade.

Passed the fable test in Average Adult, and the eight digits in Superior Adult.

One grandfather a banker, the other a railway official; both educated, intelligent men. Both grandmothers described as well educated and very keen. On the mother's side James McNeill Whistler, the noted artist, was a cousin of the child's grandfather. Several other relatives on this side had exceptional mental ability and physical endowment. On the father's side,

an uncle gifted as a sculptor and painter. Several very bright cousins.

Parents' notes. Parents rated M. 1 on every trait except courage and intellectual modesty, which they rated 2. Physical condition has always been perfect. Observant, excellent memory, craving for knowledge. "Has great enthusiasm for beautiful scenery, sunsets, and other beauties of nature." Is fond of animals. Superiority noted at the age of 4. Encouraged to go ahead in school but not forced. Has been praised for good report cards. No formal instruction whatever at home. Ambitious in everything she attempts. Wants to be a teacher.

One year later, age 10–2. The mother writes: "Health good. She awakens more and more to beauty, takes great pride in her work, and shows great love for reading. All of her work a pleasure except arithmetic (I wish arithmetic were a little more practical). Makes friends easily and is very companionable with older children. Wants to draw and loves scenery and pictures. Her best chum is a school girl of fifteen years." Average parent rating at this time, 1.60.

Teacher's notes. Unusual ability to carry a melody in two-part singing. Reads music well. Exceptionally good in penmanship. Superiority general. The teacher rated all the traits 1 except general health.

No. 25. Boy: A. W. Brother of No. 26. Underestimated by teacher and dislikes school. Very sensitive.

Age 13–1; mental age 18–6; I Q 141; low-seventh grade.

A.'s vocabulary score was 84, which is equal to that of the average Stanford University senior. Missed only two tests in the scale, the ingenuity test and repeating seven digits backwards.

Both A. and his sister are very superior but A. seems to be more original and better informed. Until a few months before the test A. had always attended a country school. His grades in school are good, but not exceptionally superior. He has no hesitation in saying that he does not particularly like school. The teacher rated him 3 ("average") on all but two of the twenty traits. She sees nothing exceptional in this boy's mentality, although he is better informed and has a larger command of language than the average teacher. One wonders whether the teacher's misunderstanding has anything to do with the boy's dislike of school.

Parents' notes. Health good except for chorea, which has now practically disappeared. As a small child he was very timid, and he is still sensitive. Remarkable memory, which first showed itself at the age of 4, when he learned his story books by heart. At that age he also learned most of Poe's *The Bells.* Has always used big words correctly. Learned to read at the age of 6½. In three or four months he could read all of Riley's child rhymes. "From the time when he was a young child A. has seemed to have understand-

ing and knowledge in almost everything beyond his years." Draws exceptionally well and has mechanical ability. "At four years could repeat verbatim pages and pages of books which were read to him." Allowed to go his own pace because of his tendency to nervousness. The only instruction has been in the form of answering innumerable questions. Several relatives of very superior ability. Average parent rating on traits, 2.05.

Later, age 14–2. Health good, school marks improved; school work easier; less nervous.

No. 26. *Girl : E. W.* Sister of No. 25.

Age 11–5; mental age 16–11; I Q 148; high-seventh grade.

All the tests in Average Adult passed except the code; eight digits direct order, and seven digits reversed passed in Superior Adult.

Parents' notes. Age of talking, 20 months. Health excellent. Has always been intellectually alert beyond her years. Ambitious to excel. Is very practical. Has always had an excellent memory and early learned nursery rhymes and jingles. Superiority first noticed at the age of 4. Is musical. Allowed to go her own pace, "as she seems inclined to go quite as fast as is good for her." No formal instruction at home. Desires to become a teacher.

No. 27. Boy: R. K. Exceptional heredity.

Age 8–9; mental age 12–4; I Q 141; fourth grade.

Age 11–4; mental age 16–8; I Q 147; high-seventh grade.

Father a mining engineer, mother a teacher. Paternal grandfather a teacher of superior ability. One uncle a doctor of divinity and "a bright scholar." One cousin is a "mechanical engineer of exceptional ability." Another cousin, a post-graduate of Harvard, is said to be one of the best mathematicians that Harvard has had in years. Relatives farther back on this side were Roger Williams and Colonel Crawford.

Maternal grandfather a teacher and lawyer of ability; maternal grandmother a teacher and "a great student up to the age of eighty years." Two uncles and one aunt on this side had exceptional mental ability. One cousin is an artist of ability, and another a talented singer. Washington Irving was a cousin of the great grandfather. Another noted relative farther back was an earl of Kilnockie.

Parents' notes. R. is somewhat nervous; otherwise health is perfect. Nothing unusual in early life. Entered the second grade at 6 years, and later skipped half of the fourth and half of the sixth. Never urged on. Best work is in English and music. In his compositions shows unusual appreciation of language. Is ambitious to write. Average parent rating on traits, 1.50.

One year later, age 12–6. "R. is finishing the eighth grade with excellent marks. Work very easy for him. Health good." Average parent rating at this time, 1.70.

No. 28. *Boy: J. P.* Underestimated by parents. An exceptionally logical mind.

Age 8–1; mental age 10–10; I Q 134; third grade.
Age 9–2; mental age 13–0; I Q 141; fifth grade.
Age 11–4; mental age 15–6; I Q 137; seventh grade.

Parents' notes. The father, a college professor, was slow to believe that J. was much above the average child in ability. He has no brothers or sisters, and the parents had no general standard by which to judge him. Average parent rating, 2.44. Nothing unusual in early life, health, or training. Was taught to read at the age of 6, but has had no formal instruction.

Two years later, age 11. Health good. Tonsils recently removed. School work done without effort. Somewhat nervous and sensitive. Average parent rating at this time, 2.20, or somewhat higher than before.

Teacher's notes. "J. can stagger you with astronomical facts. Delights in historical stories. Is not contented with statements made in the text, but wants detailed information. Questions everything; loves an argument and debates with zeal and ability. Was wildly happy when appointed to lead a debate. Has a code and loves secrets. His mind is alert to every

impression. His hands are not responsive; he dislikes to write or draw, but grits his teeth and does average work to avoid having to do it over. Reasoning is his strong point. He can read any book and repeat the substance of it months afterwards. Social adaptability normal, but rather prefers to play alone. Does not care for conventionalities. Has an unusual sense of justice." Average teacher rating, 2.00.

No. 29. Boy: B. H. Very much underrated by his teacher.

Age 9–7; mental age 13–10; I Q 144; low-fifth grade.

The interesting thing about this child is that the teacher considers his ability "average, except in language." As a matter of fact, he is farther advanced in vocabulary than in his general mental development. He is under-age for his grade, and has been rated by the teacher in comparison with children two and three years older.

Fortunate heredity. Two uncles on the mother's side unusually intelligent; one was a prominent lawyer when he died at the age of 35, the other entered high school at 11 and is now editor of a large city newspaper. A great-great-uncle of the boy was a doctor of divinity and one of the foremost of pulpit orators in the South. B. has two brothers almost as bright as himself.

Parents' notes. Health perfect, but sleep not very

sound. "Have encouraged him because he is not ambitious." Was given no home instruction except for about a year when he started to school. Average rating on traits, 2.65.

One year later, age 10½. School work good, except that his penmanship is poor and his written work somewhat untidy. This sometimes lowers his grades. Improvement in social adaptability. Average parent rating at this time, 2.45.

No. 30. *Boy: L. G.* Underrated by parents. An "only" child. Marked precocity.

Age 8–3; mental age 12–2; I Q 142; high-fourth grade.

Passed the clock test and the induction test in 14, and in Average Adult repeated six digits backwards. Vocabulary score, however, only 25, which is not more than a year above his actual age.

The most interesting thing in the data furnished by the parents is the fact that they rate the child 3, or average, on eighteen out of twenty traits. One wonders whether this is because L. is an only child and there is no standard of comparison in the home. The average teacher rating is 2.20.

Parents' notes. Health good. Learned to read at the age of 4. Above average in power of concentration. Became interested in books at the age of 2 years. Was persistent in effort to understand meaning of

words and characters. Memorized and recited readily at the age of 2 years. "Have not encouraged him to forge ahead, but have not held him back. Little instruction at home beyond the teaching of sounds of letters. Have also tried to answer all his questions and to point the way to further investigation. We think the child has a tendency to read too much."

No. 31. *Boy: C. M.* Underrated by teacher. Exceptional heredity.

Age 8–6; mental age 12–0; I Q 141; high-fourth grade.

This case is mentioned chiefly because of the following statement of his teacher: "I would say, taking my class as a basis of judgment, that C. is an average child." The teacher admits that he is doing excellent work in the high-fourth grade, also that the class is an unusually satisfactory one. She neglects to note that the average age in her class is about 10 years, while that of C. is only $8\frac{1}{2}$.

A sister of 15 is almost as bright as C. The father is a minister, a graduate of a theological seminary. Maternal grandfather an army officer and graduate of Oxford. Maternal grandmother very musical. Of eight uncles, two were able lawyers, and three were successful engineers. The mother's grandfather was one of the most prominent Canadian statesmen of his day. Paternal grandfather a college graduate;

paternal grandmother musical. The only uncle on this side is an expert chemist, whose sons show unusual ability in literary lines. The father's grandfather was one of the leading spirits in the old Hudson Bay Company.

No. 32. Girl: M. C. Brightest girl in the Stanford records. Superior family of children, ordinary heredity.

Age 7–10; mental age 13–8; I Q 174; fifth grade.

This child, tested by Miss Blanche Cummings, Director of Special Classes in Fresno, California, is the brightest girl of whom we have a record at Stanford University. Her development will be carefully followed.

The father is a jeweler; the mother was a milliner before marriage. Neither parent had more than a common school education. There are three other remarkable children in the family; a sister, age 11, in the seventh grade; a brother, age 10, in the fifth grade; and a brother, age 6, in the second grade. The last named tested at 136. No other relatives of superior ability are known to the parents.

Parents' notes. Nothing unusual in health or physical development in early childhood. Was given no instruction, but learned to read by her own efforts at three years. Was permitted to use a typewriter and with it learned her letters, figures, reading, and spell-

ing. Entered school only a year and a half ago, and has attended four different schools. Notwithstanding these frequent changes she has made five grades in that time with ease. "M. is more inclined to be firm and stubborn than the other children." Desires to become a school teacher. Average parent rating, 2.70.

No. 33. *Boy: P. E.* Early indications of superior intelligence. Apparent moral inferiority.

Age 9–5; mental age 13–9; I Q 146; seventh grade.

Age 11–3; mental age 16–10; I Q 150; first year high school.

Both parents physicians. Maternal grandfather a journalist and politician who knew seven languages. A cousin on the mother's side is said to be as bright as P. Mother's relatives chiefly doctors, lawyers, and ministers.

Parents' notes. P. knew his letters at 14 months and could read at 2 years. Learned to count at the age of 2 years. A little later knew numbers as far as the thousands and could find numbers in the telephone book. "When 4 years and 3 months old had read a good part of the Bible and read as well as a boy of thirteen." Always insisted until told what he wanted to know. Entered the third grade when he started to school at 6, and made nine grades in four and a half years. Memorizes very rapidly. Once became possessed of a desire to know the location of every town, river, and mountain,

and read the atlas through. Great collector of stamps, coins, foreign transfers, etc. "I have encouraged him. I consider a child may just as well be learning something as to fool away his time. I never made him study. While he was a small child I bought blocks with letters and numbers, maps to be put together, geographical games, alphabetical and numerical boards and other playthings with which to learn. Later bought him a typewriter, which he soon learned to use." Play life fairly normal, but made difficult by the fact that his classmates are much older and larger. With them he cannot be a leader, while with younger children he is somewhat domineering and bossy. Obeys while at school, but is rather selfish and imperious at home. The mother accounts for this by the fact that he is an only child and has been allowed his own way. Mother's average rating on traits, 2.70. Desires to become a professor of mathematics and English.

Later, age 12. Was out of school last term and worked as collector for a newspaper, making $25 a month. His vocational ambition now is to be a banker. School marks still excellent, but hardly as good as before. "Still somewhat spoiled, selfish and occasionally unkind in his criticisms of others. Compels boys of his size to do as he says. Strong willed. Punishes himself rather than give in. Needs a man's influence."

Notes from school principal. Undoubtedly great

native intelligence. Seems very learned. His ability is certainly general. Often appears not to be attentive, but later surprises one by being able to repeat everything that has been said. However, is spoiled and vain and is looked upon with a certain amount of distrust. Is said to have abnormal sex interests. Once attacked a small boy with a knife. Effusively affectionate toward his teacher, but disrespectful toward his parents. Stubborn and willful. His school conduct, however, absolutely beyond reproach.

Teacher's notes. Ability rather one-sided. Remarkable memory for facts, but lack of judgment. Has few playmates. Reputed to be a bully among younger children, although he did not show this at school. Is tyrannical toward his mother and grandmother. Average rating, 2.89.

Another teacher states: "His analysis, interpretation and memory for detail in *Julius Cæsar* and *Ivanhoe* have been far above the average of his class." This teacher described P.'s ability as general rather than special, and gave an average rating on traits of 1.55.

There is no question about this boy's unusual ability. Some would perhaps account for it on the ground of his early instruction, but we doubt the validity of such an explanation. The boy's social and moral development does not promise well, although his present objectionable tendencies may be out-

grown later. This is our only superior who has evidenced questionable moral traits.

No. 34. *Boy: H. H.* Early instruction accompanied by marked indications of superior intelligence.

Age 6–0; mental age 9–4; I Q 156.
Age 8–9; mental age 12–10; I Q 147; seventh grade.

In the second test, age 8–9, the vocabulary score was 55 (nearly 10,000 words). This is better than the median for 14 years.

Little is known of the ancestors of H. except that both of his grandfathers were farmers with only a common school education. One distant relative was a lawyer of national reputation. The father is a teacher and the mother a woman of marked intellectuality. The accomplishments of H. were exploited in a number of newspapers in 1912–13.

Parents' notes. Was specially instructed in early childhood by the mother, who early began reading to him such literature as *Hiawatha, Julius Cæsar, Bible Stories,* etc. Learned to read at 4. At 6 was able to add, subtract, multiply and divide numbers as far as the millions, to keep the family accounts, make up bills, etc. Mastered the number combinations by playing dominoes, and learned a great deal of geography by playing post office and writing addresses on envelopes which he gave to his mother. Has accumulated a rich store of knowledge about nature. All

his work is play to him. Plays the piano quite remarkably for a child of his age.

Later, age 8. Not specially fond of school. Does little home study; reads only three or four hours a week. Spends most of his time at play. Mother's rating on traits, 2.10.

Teacher's notes. A very lovable child, and below average only in leadership and initiative. "Wonderful knowledge of history. Is always ready with stories to illustrate a point. Especially good in oral composition. Large fund of general information." Ability slightly one-sided. Does not seem to fit in with the play life of his classmates. Reads a great deal, including Dickens's novels, Shakespeare stories and child verses. Rather restless. "Exceptionally poor in writing and other handwork, but amazes one with his knowledge of historical events." Average rating on traits, 1.95.

Later, age 9–10. Described by the succeeding teacher as in good health, growing very rapidly and more interested in play and companions. Marks still high. Improvement now in social adaptability. Average rating on traits at this time, 2.10. "When he came to us a little over a year ago he was extremely restless and timid; spoke in very low tones, flushed easily, and never volunteered remarks. Recently he has relaxed, plays ball, worships the big boys, and has sprouted physically. With this has come a sudden interest in assigned tasks which seems very promising for the future."

No. 35. *Girl: E. W.* Ill-health. All-round ability. Exceptional heredity.

Age 14–2; mental age 19; I Q 134; high-seventh grade.

E. is in the grade corresponding to chronological age. However, she was out for two years at one time and has missed at other times on account of illness. Although she has attended school only intermittently for five years, in this time she has completed seven grades. Considering her health, it is perhaps best that she has not been promoted more rapidly.

The teacher says: "No matter what E. has to do it is always well done. She has a wonderful power of concentration, a keen sense of humor, and never gives up until the battle is won. Her examination papers are a wonder to her teachers. They are always to the point and definite. E. has decidedly all-round ability." The teacher rated her 1 on every trait except general health.

Parents' notes. A good deal of ill-health from three to ten years. Somewhat nervous and irritable when fatigued. "Reads as many hours as we allow." Has spent many happy hours delving into children's encyclopedias. Never had any formal instruction at home. One sister and one brother of little if any more than average ability. "E. has always been first to grasp the meaning of a game, puzzle, or any subject under discussion." Average parent rating on traits, 1.65.

One year later, age 15–4. Health not quite so good. Marks satisfactory but not quite as high as formerly. Inclined to worry over her school work. Average rating now, 1.95.

The maternal grandfather was a school teacher of "fine ability." Maternal grandmother "a student to the age of 82." Uncles are successful professional and business men. One aunt a talented musician. The mother's brother was a leader in his university class, but became insane. The paternal grandfather and grandmother were school teachers. One uncle on this side is a lawyer and judge. E.'s great grandfather served the longest term in the New York state legislature of any man up to his time. Of two other relatives on this side, one was a noted Congregational minister in New York City, the other a famous surgeon.

No. 36. *Boy: J. E.* Exceptional heredity. Difficulty in social adjustments.

Age 11–0; mental age 16–1; I Q 146. School work irregular, but chiefly in the fifth and sixth grades.

J. made the remarkable vocabulary record of 74 correct definitions. He also passed the test of repeating eight digits in Superior Adult.

Has been kept back in his studies by ill-health (incipient kidney trouble), from which he had largely recovered at the age of 15. Has been educated by a governess and in private schools. Teachers consider him

very unusual in ability but hardly up to average in social adaptability.

J.'s greatest difficulty has been in submitting to formal instruction and in adapting himself to other children. Until 11 years old he had but few opportunities to associate with others and was considered more or less erratic. His social adaptability, however, has steadily improved, as has also his tendency toward irritability and imperiousness.

Both of J.'s parents are of English descent. The father is a scientist, educator, and publicist. Two of J.'s brothers are of average mentality; one sister, now dead, was very superior, and another sister is a woman of very exceptional ability. A number of superior relatives on both sides. One uncle, on the mother's side, was an Admiral in the United States Navy. Relatives farther back distinguished. Many distinguished relatives on father's side, one of whom was Ralph Waldo Emerson.

Parents' notes. As an infant J. was much disturbed by loud or sharp noises. Showed superior ability early. While still a small child drew diagrams of "inventions" which proved to be actual parts of machines he had never seen. Great interest also in astronomy. Listed stars of the fourth magnitude. At present (age 11) works in the laboratory with shells, doing a grade of work which few university seniors can surpass. Will soon publish a book on California shells. Expects to become a scientist.

Four years later, age 15. Health improved. Some lessening of enthusiasm in scientific work on shells, accompanied by marked increase of interest in manly sports. The expected book has not been finished. Excellent school marks; work done with decided ease. Social adaptability now average. An awakening sense of responsibility. Average parent rating, 2.40. At this time J.'s teachers also testify to his marked improvement along social lines.

No. 37. *Boy: M. A.* Inferior school work and marked lack of social adaptability.

Tested first at 10–11; mental age 15–0; I Q 137; eighth grade.

When tested nearly a year later the I Q was 138 and he was in the first year of high school.

Heredity exceptionally good. Father an able lawyer; mother formerly a teacher in a city normal college. Many prominent men and women among his relatives, one of whom was Samuel Adams.

An exceptionally bright boy but a problem for his teachers. Although his mental age is well above the average in the first year of high school, his grades run from C to D. Is temperamental and more or less queer. Easily takes a dislike to teachers or classmates. Regards his school work with more or less contempt and part of it he refuses to try at all. Because his school work is poor some of his teachers consider his intelligence only average.

Teacher's notes. An unusual ability to associate facts, particularly scientific facts, and to repeat from memory after one reading. Rated 4 in social adaptability, leadership, emotional self-control and unselfishness. Is babyish in his play. Nervous; has muscular twitchings and is easily embarrassed in class. Is selected by his fellows as the one to tease, torment, and nickname. Cries easily. "However, I believe that M. will become more adjusted to his surroundings and make a superior man." Average teacher rating on traits, 2.42.

Parents' notes. Health good. No special instruction in childhood except the little he received from a workman on the ranch. Has been held back, but is now allowed to go his own pace. Reads history, scientific works and all kinds of magazines. Desires to become an inventor. Average parent rating, 1.80. (This was one of the few cases in which the parent's ratings averaged higher than those of the teacher.)

Later, age 13. Marks in high school now slightly above average, and there is marked improvement in social adaptability and emotional life. Average parent rating at this time, 1.60.

No. 38. *Boy: A. L. S.* Poetic talent combined with all-round ability.

Age 9–4; mental age 13–2; I Q 141.

This child was first brought to our attention as a result of a group test. We have not yet had oppor-

tunity to learn much about him, except that he is considered one of the brightest pupils in the school of the small city where he lives. The following poem was composed when he was 9 years old. It shows remarkable maturity of thought for a child of his age:

Do not worry over trifles, though to you they may seem great,
All your fretting will not help you, or your troubles dissipate.
If your sky is dark and gloomy, and the sun is hid from view,
Bravely smile and keep on smiling,
And your friends will smile with you.

Happiness is so contagious, and a smile is never lost;
Then why worry over trifles, though your heart seems tempest tossed.
Therefore go on life's rough journey with an optimistic smile,
See the world is good to live in, and that living is worth while.

No. 39. *Boy: J. S.* Intensive mental culture in early childhood. Fine mental balance. Has a sister who is an infant prodigy.

Age 9–6; mental age 16–4; I Q 172; sixth grade.
Age 10–4; mental age 17–8; I Q 171; seventh grade.

In the first examination, age 9½, J. passed four tests in Superior Adult, including paper cutting, eight digits direct order, seven digits reversed order, and the ingenuity test.

Special interest attaches to J. because he is a brother of Martha, who at the age of 26 months was able to read any primer.[1]

Father a lawyer and a man of more than ordinary ability. Graduated from university at 21. Mother a teacher before marriage. Maternal grandfather a farmer, of common school education and average ability. Uncles and aunts average or somewhat above. Paternal grandfather a bookkeeper of business college education and average ability. Paternal grandmother of average ability, common school education.

Father's notes. J.'s superior ability first evident in third year. Father accounts for the superiority as "due to the fact that we deliberately set ourselves to the task of educating him when he was a young child. When J. was a mere baby I determined to start his education. Commencing at the age of two years I adopted artifices to make his play a source of education and kept at it persistently until he was five years old and had acquired the fundamentals of the first three years of school, after which I dropped the matter. In the case of the second boy, I had no time to take that course and did not do so." (Second boy only average.)

Father describes J. as serious and dreamy, finding his greatest pleasure in reading. Little interest in tools or machinery. Quite different from the boisterous, happy-go-lucky younger brother. If left to his

[1] See *The Journal of Applied Psychology*, 1918, pp. 219–28: "An Experiment in Infant Education."

own devices would spend all his leisure reading. Health always perfect except for scarlet fever at 5 years. Average rating on traits, 2.35.

One year later, age 11½. Health good; adenoids and tonsils recently removed. Average of father's rating on traits now 1.75. Marked improvement in social adaptability.

Teacher's notes. "J. is a boy of wonderful ability for his years. In arithmetic he never draws an unwarranted conclusion or premises anything unnecessary to the conclusion." When he started to school he covered the first grade in a half day, the second grade in two months, the third grade in six months, and the fourth grade in two months. All but one of the twenty traits graded 1 by the teacher, with special emphasis on the boy's lack of vanity.

Play interests and play life described as normal. No physical handicaps, nervousness, or eccentricities of any kind. "In every respect normal with the exception of superior intelligence."

No. 40. *Henry.* Illustrating the relative independence of I Q and schooling.

Scientific ability overshadowed by musical genius. Extreme poverty.

As a near neighbor boy, Henry has been under our observation since the autumn of 1910. At that time he was a little more than 12½ years of age. He was tested at 14½, earning the mental age of 19 (I Q 131).

Although the I Q is satisfactory, it is matched by scores of others among our records; but there is only one Henry.

Henry had never been to school except for a few months when he was 6 years old. He lived in a little shanty with his semi-invalid mother and was the sole source of income for the support of her and himself. He tramped often to the mountains in search of rare wild flowers which he brought home and sold in beautiful bouquets to people who knew him. Sometimes he weeded lawns or did garden work for his neighbors. For some years also he served as janitor for a little rural school near his home. His earnings rarely amounted to more than $15 a month, but somehow he and his mother managed to live on this amount.

Henry's mother, since dead, was a woman of refinement and intellectuality, the author of two novels and a number of poems. She also wrote essays on sociological questions, at least one of which was published in an English periodical of international circulation. She was an idealist, imbued with advanced notions regarding religion, sociology, and woman's place in the world.

Henry's mother was almost 50 years old when he was born. His father was an unsuccessful member of a distinguished family. Henry's paternal grandfather was an Archbishop of Ireland, and dukes and earls are numbered among his cousins.

Shortly after Henry started to school, at the age of 6 years, he was one day seized on his way home from school with a strange muscular paralysis. He fell to the ground and had to drag himself home. Chorea set in, from which he suffered severe recurrent attacks for years. Except for occasional twitchings, he had fairly recovered at the age of 14, and somewhat later his recovery was practically complete. On account of this nervous tendency, however, his mother did not see fit to send him to school, nor did she give him much formal instruction at home. She talked with him endlessly, read to him occasionally, and sometimes he read to her. They discussed religion, politics, and matters of literature and art. We have a list of over three hundred books which Henry had read before he was 14 years of age, also bulky notes of extensive conversations which we had with him on such questions as socialism, atheism, scientific problems, etc. At 14 he discussed these matters with greater breadth of knowledge and much deeper understanding than the average university senior. No less striking was his ignorance in certain school subjects. His spelling was wretched, and he had studied no formal arithmetic above the four fundamentals and simple fractions.

As a boy of a dozen years, Henry's appearance was odd and interesting in the extreme. His speech was quaint, and rather drawled and stilted; his face was childish, but he looked at you with eyes that seemed utterly void of self-consciousness; his clothes were

often ragged and always ill-fitting; his hair hid his ears and straggled down to his shoulders; his face and shoulders twitched occasionally with choreic spasms.

Everybody considered Henry as queer, not to say freakish. If employed to weed a lawn he was likely to forget what he was doing while trying to compose and whistle a tune. His janitor work was hardly more successful. Henry had shown promising ability with the violin at the age of five years, but his chorea had put an end to his musical practice. Neither violin nor piano was touched again until he was about 15 years of age. His musical talent, however, survived all the vicissitudes of poverty and illness. Henry knew that his nervousness, and still more the effect of hard labor upon his hands, had ruined forever the hope of his becoming a great musical performer; but he would become a composer. Day and night he dreamed of this and wrote out in musical notation numberless compositions.

At the age of 15, having practically recovered from his chorea, Henry resolved to gratify a long cherished ambition — he decided to purchase a piano. He found an old second-hand one and bought it for $60.00, which sum he managed to save out of his scanty earnings by doing without various "necessities" of life. Although he had not tried to play on the piano before, within a year he was giving recitals among his university friends. Within three or four years his playing was quite remarkable. Shortly after this his playing was brought

to the attention of prominent musicians in San Francisco who, with other friends, gave him encouragement and help. He was placed under the instruction of one of the best music teachers in the West, and soon took rank as one of the most promising pupils that instructor had ever had. At the age of 19 he spent several months in New York. His compositions at this time were pronounced promising by various prominent musicians. At the age of 20, without ever having been in school a year in his life, Henry was made Instructor of Harmony in the summer school of a great state university. He was reappointed for a second year, but was soon afterwards taken for military service.[1]

Those who had considered Henry as merely a queer child with impossible ideas and exasperating manners and frankness, were finally compelled to admit his musical ability. Even then, however, he was generally considered a freak in all but his musical ability. His general intelligence has never been correctly appraised by the majority of his friends.

We have seen the verdict of the Binet test. As the result of many hours of conversation with the boy, over a period of many months, we are convinced that

[1] On the day when the author read the proof of this chapter a letter reached him from one of Henry's friends in which was the following statement: "Professor S—— (head of the Department of music in the university referred to above) says of Henry that he is the only American known to him who has really great talent for musical composition. Damrosch has promised to produce his first symphony, almost finished when he enlisted, as soon as it is put in final shape. About a dozen of his compositions are being published at the instance of Professor S——."

his ability in science was almost as great as in music. Before the age of 12 he had read university textbooks in botany. His knowledge of California wild flowers at this age was remarkable. He had studied seriously the principles of plant breeding, and for a time, when it seemed impossible to realize his musical ambitions, he considered botanical science for his life-work. He might have done so but for the fact that his education had been too irregular to permit him to enter a university

One of the most noticeable things about Henry has always been his independence of judgment. His opinions on all kinds of matters are quite pronounced, and he expresses them without regard for other people's feelings. By many acquaintances he is considered rude and ill-mannered. This does him injustice; he is merely naïvely honest, due both to his temperament and to the influence of his early training.

It remains to be seen whether Henry will become one of the famous musical composers of his day. Several musical critics of note hope for this outcome. If he attains fame as a musician, his biographer is almost certain to describe his musical genius as natural and inevitable, and to ignore the scientist that he might have been.

No. 41. *Boy: D. B.* Indications of real genius. Unequaled intellectual spontaneity.

Age 7-4$\frac{2}{3}$; mental age 13-7; I Q 184; not in school.

This is the highest intelligence quotient we have ever found, and all the supplementary data indicate that there is no other child in our list who equals D. in all-round intellectual ability.

The test was made before a class of about a hundred students at Columbia University. The day was one of the most uncomfortable in the history of New York City, the official temperature for the day being above 100 degrees. The room was close, ill-ventilated and wretchedly hot. The test began with year 9. All of the tests of this group were passed. In year 10 all of the tests were passed except that of drawing designs, which fell just short of being satisfactory. In year 12, seven of the eight tests were passed with ease. The three disarranged sentences were given without a single error in 12, 10, and 5 seconds. The five fables were interpreted as follows:

1. Hercules and Wagon Driver: "If you work yourself you will get help."
2. The Milkmaid and her Plans: "Do not build castles in the air."
3. The Fox and the Crow: "Do not listen to flattery."
4. The Farmer and the Stork: "If you keep company with bad people you will have to suffer the consequences."
5. The Miller and the Donkey: "Stick to one way."

In year 14 the induction test was passed without error, the rule being given as follows: "You multiply by two each time." The other tests passed in this

year were president and king and arithmetical reasoning. There was only one success out of three trials in the clock test. In Average Adult the fables and box test were passed. Although the examination covered a wide range of tests, it required only 45 minutes. The responses were perfectly natural, almost playful. There was no waiting for applause, no appearance whatever of vanity.

Although D. was not enrolled in school at the time of the test, he regularly attended the playground activities at the Horace Mann practice school. Previously he had attended a kindergarten. All of his teachers had recognized his phenomenal ability.

Father, Russian-Jewish; mother, Polish-Jewish. The father is an advertising man and writer, and has published three books of fiction. The mother is a high-school graduate, did some work in a university, and has written short stories and poems for various periodicals. Maternal grandfather a business man of "high intellectuality." Two cases of unusual musical ability on the mother's side, also several distinguished rabbis. Paternal grandfather a business man of unusual mechanical ability, fond of making and solving puzzles. The paternal grandmother taught herself to read English late in life. Rabbis on this side also.

D. is an "only" child. The mother is a woman of exceptionally keen and judicial mind, and has kept bulky notes on D.'s mental development since he was

a baby. She has furnished us with the following interesting items of information:

"D. stood alone between five and six months; walked at nine months, and talked at about a year. First teeth between four and five months. Nursed for only five months. No illness except measles and a light case of chicken pox. No physical defects. Sleeps about $11\frac{1}{2}$ hours.

"Played with anagrams when a baby and learned to read as gradually and naturally as he learned to talk. At three, without us knowing he could do it, he picked up a new book suitable for children of nine years and read it through intelligently. Has had some private lessons in music and gymnastics. Has also taken a few lessons in interpretative dancing.

"Dresses and undresses alone, bathes himself, cleans his teeth alone and tends to his bodily needs. Plays ball, bats and skates. Handles 'mechano' models requiring deft fingers. Typewrites rapidly, using only two fingers on each hand. Taught himself printing and typewriting.

"Reads very rapidly. If he likes a book will return again and again to it, memorizing the parts he specially cares for. Probably averages eight or ten hours a week reading. Leaves his book willingly to play, but goes back to it when play is over.

"Recently a world atlas, baseball guides, and baseball news in the daily papers have all furnished him with what he calls 'important work.' Has read a

great deal of Shakespeare with a particular liking for the historical plays. (*Pericles* is his favorite.) His knowledge of Shakespeare characters is amazing. Reads the *Book of Knowledge* and as many animal stories as he can lay his hands on. Desires to travel in order to see and learn the habits of wild animals. Has read every history book in the house, including Gibbon and Grote. He criticized Gibbon as 'having left too much out' in writing about Rome. Among his papers are sundry notes marked 'Important things the Scottish kings did,' 'List of Roman Emperors and what they ruled over,' etc. This shows that he reads to find out things which he considers important. When taken to the public library he invariably chooses books of history. Is very fond of fairy tales but has not been permitted to read many.

"D. will carry through projects extending over long periods. It took him several days to complete a map of the apartment drawn to scale; many weeks off and on, to complete a geographical map of his imaginary country, 'Borningtown,' and for a year he spent much time recording foreign state automobiles sighted in New York, with directions for recognizing the various licenses. Has notebooks and papers covered with baseball data. Keeps data embodying special features of maps, charts, etc. In reading Shakespeare pays careful attention to the notes on the text, which in the edition he is reading (Knight) are voluminous. A recent interest which has taken the place of the foreign autos

is that of the trolley system of New York City. His pockets bulge with notes and transfers (together with marbles, with which he plays at every opportunity).

"Plays games with cards, a baseball game, and a question game. The latter is an information contest. In the game of characters his side always wins, for he has an inexhaustible supply of Shakespeare characters to draw upon. Similarly when it comes to cities or rivers, such sources as Russia furnish him a supply which no one else can compete with. Other games which he likes are various kinds of solitaire, chess, and quite a difficult game shown to him by a teacher of mathematics, a game in which he outplays every one by his unerring calculation in what he called its 'double corner.'"

The foregoing notes refer to D.'s reading and abilities prior to August, 1917. In March, 1918, the mother writes as follows:

"His Shakespeare interest holds, but he has read recently much less history. Has developed an interest in the scientific articles in the *Book of Knowledge*. Recently showed me a toy telescope which he had made out of his old miscroscope and mounted on the steel parts of his mechano. Spends hours over his toy train tracks. Once calculated how long it would take his little train to run a mile at the rate it went around his track; measuring in the center of the track, he explained, 'to be sure to get the exact answer.'

"Last year his expressed vocational ambition was

to be a baseball player. Later, he said that while he had not given up his plan to be a baseball player, he had decided also to be an author. This was while he was deep in his ventures of book writing, having begun three or four different books in the fall of 1917 and finished a play for his mother's birthday. He has begun a book called *Borningtown*, with chapters and headings already planned; also another book called *Facts about Borningtown and Washabett*, with table of contents and headings for fifty chapters! Of the text so far there are five typewritten pages and one illustration. A third book is about *Bully Wully, or the Magical Egg*.

"Another new interest is the dictionary he is making of 'Borningtown.' Many of the words which he makes up for this dictionary are intended as improvements on the English language. For example — 'smallen,' to make small. His interest in words and their derivations led us to begin this year a little formal Latin, at which he spends about an hour a week. His ability to analyze and classify have made it quite easy for him to learn thus far the first and second declensions of nouns and adjectives and a few conjugations.

"He learned to count, to add and to subtract by means of playing cards, which were among his first playthings. Formal arithmetic was begun when he was 7 years old by spending about an hour a week upon it. This year he is giving about an hour each

week to algebra and about as much to geometry, with his father as teacher. He has no difficulty with either subject. Often sets himself problems in geometry to solve.

"In the study of music has applied his ability to analyze and arrange so that he has made big strides in musical theory and wants to compose melodies to fit the words of the poems he selects.

"Conscientious. Refuses to lie. Clings tenaciously to a standard which he recognizes as desirable. Used to mark himself for what he considered good writing and was quick to acknowledge poor work. Obeys instructions regarding errands, etc. Above average in unselfishness. Makes plans to give pleasure to others, and often, with a manifest effort, of his own volition leaves the best or biggest for some one else. Loves to share his pleasures. Will remark at selfishness in others."

The above account contains so many things it is hard to associate with the chronological age of 7 years that the reader may be inclined to allow something for maternal prejudice. To do so in this case would be a mistake. The Binet test, made under extraordinarily unfavorable conditions, indicates a level of mental ability not far below that which is normal for children of 14 years. We have also the testimony of the kindergarten and playground instructors in the Horace Mann school, which agreed thoroughly with the notes

furnished by the mother. The average rating given by the mother on the twenty traits was 1.93; that of the kindergarten teacher who knew D. best, 1.90. His former kindergarten teacher says: "D. is a most remarkable boy. His greatest difficulty has been social adaptability, but his experience in kindergarten and playground has brought him well up toward the normal in this respect. Reads the Iliad and Shakespeare and publishes a weekly playground newspaper."

One who desired further proof of D.'s exceptional intelligence would find it in convincing abundance in any issue of this newspaper, which is a rare essay in journalism for a boy of 7 years. It is a one sheet, three column affair, typed. All of the composition is done by D. who "prints" it on his typewriter. There is a joke section, an advertising section, a news section, and various extras and incidentals from time to time. The jokes are often such as would not be understood by children below the mental level of twelve years.

It will be seen that D. is far superior in general ability to any of the other children we have described. His ability seems to compare favorably with that of Francis Galton,[1] who in childhood showed similar indications of genius. Whether the promise of the present will be fulfilled, only the future can tell. How-

[1] Terman, Lewis M., "The Intelligence Quotient of Francis Galton," *American Journal of Psychology*, 1918. Compare also "The Psychology of a Prodigious Child," *Journal of Applied Psychology*, 1917, by Leta S. Hollingworth and others.

ever, considering his fine balance of personal, moral, and intellectual traits, there is every reason to believe that he will become a distinguished man.

Indications of superior endowment. Doubtless the reader has sensed a degree of monotony in the above descriptions of superior children. Such children show the usual individual differences in temperament and personality, but intellectually they have much in common. Certain qualities are mentioned again and again by both parent and teacher. Phrases most often used in giving indications of superior endowment are the following:

"Alert beyond his years";
"Has such keen powers of observation";
"Shows a passionate desire to learn";
"Asks endless questions";
"Is interested in everything";
"Is ambitious to excel";
"Gets the highest school marks";
"Writes such wonderful examination papers";
"Has such a fine command of language";
"Has fine reasoning powers";
"Shows independence of judgment";
"Is an original thinker";
"Answers always to the point";
"Has a keen sense of humor";
"Has unusual power of concentration";
"Is more dependable than other children of his age";

"Conscientious to a fault";

"Such a lovable child"; etc.

Many are also described as exceptionally truthful, sympathetic, generous, thoughtful of others, and endowed with a sense of moral responsibility which shows itself in a willingness to work and to deny themselves for social ends. Other symptoms of superior endowment receiving frequent mention include the early learning of nursery jingles; ease of memorizing; learning, without instruction, to count and to name the days of the week and the months of the year; rapidity of learning to read; learning to read without instruction by means of newspapers, advertisements, or telephone books; desire to write; love of reading; preference for worth-while books; liking for dictionaries and encyclopædias; absorption with hobbies, such as collections, wireless telegraphy, and educational games. These indications are mentioned so often as to appear well-nigh universal with this class of children.

Only a few have traits that are undesirable. Several are more or less nervous, a few are exceptionally timid, three or four are somewhat vain, a few dislike the routine and restraint of the school, one is rather lazy, one lacks affection, one shows symptoms of incorrigibility at home, and several are below average in leadership and social adaptability. Making proper social adjustments is perhaps the most difficult problem for these superior children. Their intellectual superiority tends to set them apart from children of their own age, while

they are at the same time prevented from equal association with older children both by their lack of physical strength and by the relative immaturity of their play instincts. No. 42, for example, who at the age of 7 tests above 13½, obviously cannot compete with average 13-year-old boys in the usual games of physical skill, nor is he near enough adolescence to share their mental outlook. His play interests are in many respects like those of ordinary children of 7 years; yet he is largely cut off from natural association with such children by the fact that he speaks a different language. His vocabulary is so "grown-up" that his playfellows often cannot understand what he is talking about. Considering such difficulties, the wonder is that only two or three of our superior children are noticeably queer socially, and that only one borders on the "outcast."

Objections to grading superior children by mental age. The question may be raised whether the difficulty of social adjustment does not constitute a serious objection to the plan of grading superior children according to mental age, since this would associate them in class work with children who are several years older. This danger, however, is largely offset by the opportunities which the playground offers for making congenial acquaintances. The injury done by having such a child recite with children whom he cannot compete with in play must be very slight compared to the intellectual and moral injury which is wrought by

keeping him always at tasks which are too easy to command his best efforts.

One solution would be to have the child of exceptional ability remain out of school every second or third year. This would tend to keep him in class with children of about his own age, while at the same time requiring a reasonable amount of effort to keep up in school work. The plan assumes, however, that the school authorities will allow such a child to skip the grade which his fellows take while he is out of school. If this were not allowed, and often it would not be, the situation would only be made worse. The plan of "periodic rests" has the further objection that by depriving the child of the social opportunities which the school offers it would make his isolation more complete. Besides, there are few homes which could be expected to fill the child's free year with experiences of real educational value.

Opportunity classes for superior children. The responsibility for the right education of superior children belongs with the school. If the opportunities now offered are not suitable, it is the duty of the school to provide something better. While some relief is furnished by an elastic system of promotion which will allow the superior child to skip a half grade occasionally, this should be regarded as a makeshift rather than a final solution of the problem. The contribution of the school must be more positive and more educational. If the needs of superior children are to be

met, special classes and special courses will have to be provided. The advantages of such classes are many.

(1) They allow children to make rapid progress without skipping vital parts of the subject-matter;

(2) They allow a broadening and enriching of the course of study because of the larger accomplishments possible to superior minds;

(3) They are a discouragement to vanity because the level of competition is raised and the measure of a child's success depends upon his relative standing in the class;

(4) They insure the mental and moral training which can come only from sustained effort;

(5) They furnish an atmosphere which is intellectually much more stimulating than that found in the average class;

(6) Since they bring together children of similar age and attainments, they go far to solve the problem of social adjustment.

Wherever "opportunity classes" for bright children have been tried they have proved an immediate and surprising success. The children are touched by new life and inspired with new enthusiasm. That two or three grades are usually covered in one year is perhaps a matter of secondary importance compared with the intellectual awakening and the intensification of effort which such classes provoke. The results have been

so uniformly successful that the special class for gifted children may be considered to have passed the experimental stage. The following illustration is typical:

In February, 1917, an opportunity class was formed in Louisville, Kentucky. It consisted of 21 children selected by means of Binet tests. The intelligence quotients ranged from 120 to 167, fifteen being above 135. The class covered the work of an entire grade in a half year. "Besides the accomplishment of this work, the children learned to use with a considerable degree of freedom 400 words in conversational German. They also composed the words and music of a spring song and an operetta. The class did this work happily and with ease. Home study was discouraged, except where it was a matter of great desire, and then it was limited to twenty minutes. . . . In character and disposition these children are conceded by all who know them to be superior. They are not conceited or puffed up by their selection for the class." Miss Race, from whom the above is quoted, states that whatever touches of conceit were present at the beginning of the class were largely eradicated before the end of the term.[1]

A similar class has been conducted in New York City by Miss May Irwin,[2] and another in Urbana,

[1] Race, Henrietta, "A Study of a Class of Children of Superior Intelligence," *Journal of Educational Psychology*, 1918, pp. 91–97.

[2] See Louise F. Specht: "A Terman Class in School No. 84, Manhattan," *School and Society*, March 29, 1919, pp. 393–98.

Illinois, under the direction of Professor Whipple.[1] In both cases the results agreed in a striking way with those of the Louisville experiment.

Class sectioning according to mental ability. When the school system is very small, or when other conditions prevent the formation of a special class for the children of exceptional ability, their needs may be to a certain extent provided for by the division of the regular class into three sections: a slow-moving, a normal, and a fast-moving group. For example, in a second-grade class of forty pupils the groups might contain ten, twenty, and ten pupils respectively. These could be instructed by the same teacher, but as separate classes making different progress and doing work of somewhat different quality. The work of the three sections could be so organized that their separate instruction would be by no means an added burden to the teacher.

This chapter has been largely devoted to descriptions of children of very exceptional superiority. Probably not more than one child in a hundred tests above 135 and not more than one in two hundred above 140. The children who test between 120 and 135 are several times as numerous, and almost equally in need of special advantages. It is from this group that the majority of teachers, doctors, lawyers, ministers and other professional men and women come.

[1] Whipple, G. M., *Classes for Gifted Children* (School and Home Pub. Co., Bloomington, Ill., 1919); pp. 151.

Special classes for eight or ten per cent of the pupils are perhaps not feasible and may not be necessary, but much can be done by the sectioning of classes in the manner just indicated and by making the system of promotion more elastic.

CHAPTER XII

INTELLIGENCE TESTS IN VOCATIONAL AND EDUCATIONAL GUIDANCE [1]

Educational and vocational guidance inseparable. Vocational guidance usually receives attention only on the eve of the child's departure from school. Thus restricted, it falls greatly short of its possible value. If the pupil is to be properly trained for his life-work, as well as directed to it, his education must at every step take account of his vocational possibilities. That is, vocational guidance must be preceded by educational guidance.

Previous chapters have shown how frequently the school errs in attempting to force children through courses of study which are beyond their intellectual capacities, and how futile and discouraging such efforts are. A large proportion of children must leave school with little direct preparation for life, simply because they are intellectually incapable of mastering the contents of a curriculum which the school has set up as theoretically desirable for all. It is time that the school should ask not only what it would like to do, but what it can do. Facts have been presented which show that the limits of a child's educability can be

[1] See also Hollingworth, H. L., *Vocational Psychology* (D. Appleton & Co., 1916); pp. 308.

fairly accurately predicted by means of mental tests given in the first school year. By repeated tests these limits can be determined accurately enough for all practical purposes by the end of the child's fifth or sixth school year. This early, at least, vocational training and vocational guidance should begin.

The end is not merely that of keeping the child in school. This in itself is not necessarily desirable. In the conservative school system offering only the traditional courses, it is perhaps just as well that pupils of 80 I Q or lower (i.e., 10 per cent of all) should drop out by the age of fifteen years. By that time they have gotten about all they can get from the older type of restricted elementary curriculum. Continuation would mean nothing more than to remain hopelessly stranded in the sixth or seventh grade, without further effective training except training in failure.

Limitations of vocational guidance. It must not be supposed that vocational guidance, in the sense of determining exactly which of a thousand or more vocations a given individual should enter, is yet possible. The most important contribution which psychological tests are at present prepared to make is in the measurement of general intelligence. The special abilities which so largely influence success in the majority of vocations have not yet been satisfactorily analyzed, much less measured. The intangible factors of interest, will power, social adaptability, leadership, and personality are still less subject to exact determina-

tion, although their combined influence upon vocational success is doubtless very great. One's general ability may fit him equally for success in a dozen different vocations, and in this case the ultimate choice should depend upon practical considerations, natural interests, and various traits of personality.

Nevertheless, intelligence tests will be of great value in vocational guidance, even if they tell us nothing more than that reasonable success in a given vocation is or is not compatible with the general mental ability which an individual possesses. The saddest as well as perhaps the most common failures in life are due to the selection of a vocation which requires a higher grade of ability than the individual possesses. Hardly less unfortunate is the person whose too modest self-estimate lands him in an occupation that is intellectually beneath him. A mistake in either direction entails bitter disappointment, since often it is not discovered until the time for new choices has gone by.

Mistakes of this kind can be largely prevented by intelligence tests as soon as the proper factual basis has been laid. First, however, it will be necessary to find the actual ranges of intelligence represented in the different types of vocations, and especially the lower limit of intelligence which permits reasonable success. It will also be necessary to determine for each typical vocation the level of mental ability which represents the "point of diminishing returns," in order to prevent superior ability from being wasted upon voca-

tions which make only moderate intellectual demands. Tests in sufficient number will doubtless show that there exists for most vocations a middle range of mental ability in which the chances of success are near the maximum, that intelligence below this range becomes less and less favorable to success until a "dead line" is reached, and that ability of a higher order represents only so much sheer waste. When such standards of occupational intelligence are available, they will furnish the most important single basis for vocational and educational guidance. Knowing the intelligence of the child we could then select the vocations well within the range of this intelligence, and leave it to the child's natural interests and to practical considerations to make the final choice. Such a method would not eliminate the possibility of vocational failure, but it would eliminate one of its most common causes. Until the intellectual requirements of the different vocations have been more definitely established, some suggestion for guidance may be gleaned from the following studies of typical vocational groups.

Firemen and policemen. In 1916 the city of San José, California, made an unusual experiment, perhaps the first of its kind in this or any country.[1] The experiment involved a civil service examination for positions in the fire and police departments, based entirely upon standardized mental and educational

[1] Terman, Lewis M., "A Trial of Mental and Pedagogical Tests in a Civil Service Examination for Policemen and Firemen," *Journal of Applied Psychology*, 1917, pp. 17–29.

tests. The tests used included the Stanford-Binet intelligence scale, the Trabue Completion Test, the Thorndike Oral Reading Test, the Courtis Standard Test in arithmetic, a handwriting test, and the Otis tests of spelling and arithmetical reasoning.

Thirty candidates presented themselves in competition for the ten or twelve prospective openings. All were American born, with ages distributed fairly evenly between 21 and 38 years. Their incomes during the previous year ranged from $420 to $1350, with a median of $960. Their previous occupations ranged from totally unskilled to skilled and high-grade clerical.

The distribution of mental ages and I Q's was as follows:

Mental age	10 to 10–11	11 to 11–11	12 to 12–11	13 to 13–11	14 to 14–11	15 to 15–11	16 to 16–11	17 to 17–11	18 to 18–11		
Number	1	2	7	7	8	2	1	1	1		
I Q	60–64	65–69	70–74	75–79	80–84	85–89	90–94	95–99	100–104	105–109	110–115
Number	1	1	2	6	7	4	4	2	1	1	1

The median mental age was 13–5, the median I Q 84.[1] The lowest fourth fell below 78 I Q, the highest fourth reached 91 I Q or above. The minimum I Q compatible with efficiency for policemen and firemen is not known, but, in the absence of a definitely established standard, all who tested below 80 I Q were rejected

[1] The reader is reminded that in calculating the I Q for adult subjects chronological age above 16 years is disregarded. That is, mental age is always divided by 16.

without further consideration. Choice from the remainder was made on the basis of personal history, and on the combined results of the various tests.

Among those testing below 80 I Q were four individuals who were already serving in the fire department as "extras." They had gotten their positions under an earlier political régime. The I Q's of these four men were 63, 74, 77, and 79. The 63 I Q individual was 34 years of age, and had never earned a wage more than two thirds as high as that paid the average unskilled laborer in his community. His deficiency is well known to his acquaintances, and he had secured his position as "extra" only through the influence of his father, a man of some local prominence.

The individual who tested at 67 I Q was pronounced by the captain of his militia company to be unquestionably feeble-minded. He had never done better than unskilled labor, and at the time of the examination was without employment. Another of 71 I Q had formerly worked as a hotel porter and also as a railroad signalman. Although the duties of a railroad signalman are extremely simple, they require attentive performance, and one may well doubt whether they can be safely entrusted to an I Q of 71.

The following notes may also be of interest as showing what may be expected of various I Q's:

I Q 77. Common laborer in a sawmill. Had served one term in the regular army, and reënlisted after failure in the examination.

I Q 78. Deliveryman for a grocery store and "extra" in the fire department.

I Q 78. A teamster, unskilled laborer.

I Q 79. No occupation except as "extra" in the fire department.

I Q 81. Had served several years as policeman in an eastern State at $65 to $80 per month.

I Q 83. A successful street-car conductor, said to be very popular with his patrons because of his genial good nature and his interest in people.

I Q 112. Had completed the second year of high school, and had earned as high as $125 per month as a salesman. His purpose in securing a position in the fire department was to secure leisure for a correspondence course in expert accounting.

Such data would suggest that the I Q of 75 or below belongs ordinarily in the unskilled labor class, that 75 to 85 is preëminently the range for semi-skilled labor, and that 80 or 85 is ample for success in some kinds of skilled labor. When the candidates were classified into unskilled, semi-skilled, and skilled, according to the occupations they had followed, the following I Q ranges and averages were found:

	Unskilled	Semi-skilled	Skilled or better
Range of I Q..........	63 to 89	74 to 96	84 to 112
Average I Q..........	75.5	85.2	98.3

Express company employees. Flanders [1] gave Stanford-Binet tests to 47 employees of a large express company. Only those were tested who had been with the company at least a year. The work they were doing is indicated by the following random selections: Accounting Clerk, C.O.D. Clerk, Settlement Clerk, Waybill Clerk, Receiving Clerk, Clerk in Value Room, Clerk in On Hand Department, Wagon Dispatcher, Chief Router, etc. These were typical of the rank and file of seven hundred employees, not including supervisors or semi-officials at one end or floaters at the other. In practically all cases the work involved a high degree of specialization, "offering exceedingly limited opportunity for the exercise of ingenuity or even personal judgment. Success is achieved by the faithful and careful performance of a simple task for the doing of which perfectly definite rules have been given." Although the work done by the forty-seven employees apparently differed little as regards the amount of intelligence required, the following wide range of mental ages was found:

Mental age	10 to 10-11	11 to 11-11	12 to 12-11	13 to 13-11	14 to 14-11	15 to 15-11	16 to 16-11	17 to 17-11	18 to 18-11
Number	1		0	9	7	13	4	5	6

The range was from 10 years (I Q 62) to 18-7 (I Q 116) with a median of 15-2 (I Q 95). One fourth were

[1] Flanders, J. K., "Mental Tests of a Group of Employed Men, Showing Correlations with Estimates furnished by Employer," *Journal of Applied Psychology*, 1918, pp. 197-206.

below 13–10 (I Q 86) and one fourth above 16–7 (I Q 104).

It is surprising to find men with intelligence which would enable them to take a college course competing with others who could never graduate from the eighth grade. As stated by Flanders, " such individuals are possibly lacking in certain emotional, moral, or other desirable qualities; it may be that economic pressure crowded them out of school before they were able to prepare for more exacting service; it may be that the schools did not provide them with suitable vocational training; it may be that they selected their vocations blindly and ignorantly. Whatever the reason there is evidently a big social and economic loss."

Flanders concludes by calling attention to the abundant occupational opportunities open to men of 70 to 80 I Q (mental age 11 to 13 years). The evolution of modern industrial organization together with the mechanization of processes by machinery is making possible a larger and larger utilization of inferior mentality. One man with ability to think and plan guides the labor of ten or twenty laborers, who do what they are told to do and have little need for resourcefulness or initiative. It is even suggested that our chief difficulty may soon be to provide enough suitable jobs for those of higher intellectual capacity. We can at least rest assured that society has and will continue to have place enough for workers of decidedly inferior intelligence provided they are given a training which is sufficiently practical and concrete.

Street-car employees and salesgirls. C. W. Waugh tested 82 street-car motormen and conductors, 61 salesgirls in a large department store, 7 railroad engineers, and 4 department store "buyers." The mental ages found for these groups were as follows:

Mental age	9-7 to 10-6	10-7 to 11-6	11-7 to 12-6	12-7 to 13-6	13-7 to 14-6	14-7 to 15-6	15-7 to 16-6	16-7 to 17-6	17-7 to 18-6
Street-car men	1	3	15	19	18	14	8	3	1
Salesgirls	2	4	14	11	8	12	8	1	1
Engineers						2	2	1	1
"Buyers"	..						1	2	1
Total	3	7	29	30	26	28	19	7	4

The medians were as follows:

Street-car men	13-8	(I Q 85.6)
Salesgirls	13-6	(I Q 84.5)
Engineers	16.0	(I Q 100)
Buyers	17.0	(I Q 106)

The work of a street-car motorman or conductor rates as semi-skilled. The investigation showed that an I Q of 80 to 90 is entirely satisfactory for this kind of work provided other traits are favorable. However, a study of the ratings given the men for efficiency indicated that a 75 I Q is an unsafe risk either for motorman or conductor. The one testing lowest, 10-5, I Q 65, had a low efficiency rating [1] and at the time of the test was laid off because of a serious accident caused

[1] Unfortunately the original data of this investigation were lost before the correlations of I Q with ratings could be computed.

by his carelessness. On the other hand, the data suggested that intelligence above 90 or 100 I Q adds nothing to the efficiency of a motorman or conductor, and that it conduces to discontent. Most of those of highest I Q stated that they were only engaged in the work because of bad luck or unfavorable labor conditions and that they looked forward to getting something better. Men testing around 80 or 85 usually seemed contented and proud of their jobs.

The work done by the salesgirls would rate all the way from unskilled to semi-skilled, or in general slightly lower than the work of street-car conductors and motormen. The I Q distribution for salesgirls, however, was about the same as that for street-car men. This is another illustration of what is probably generally true in our present industrial organization, that the economic situation for men of a given I Q is considerably easier than for women of the same intellectual ability. The data for motormen, conductors, firemen, and policemen indicate that an I Q of 85 among men receives about the same economic rewards as an I Q of 100 to 120 among women, taking the average elementary teacher, or high-grade stenographer as typical of this class.

Business men. Knollin and Zeidler tested 30 business men of moderate success and limited educational advantages. The subjects were typical of the kind of men who own or manage the ordinary stores, barber shops, draying business, etc., in a small town. None

had graduated from a high school, and only two had attended school above the eighth grade. None had accumulated any considerable fortune, and none had failed outright in business. The following mental ages were found:

Mental ages...	13 to 13-11	14 to 14-11	15 to 15-11	16 to 16-11	17 to 17-11	18 to 18-11
Number.......	1	6	7	8	6	2

The median mental age was 16-2 (I Q 102). The lowest fourth were below 15-0 (I Q 93.6), and the highest fourth above 17.2 (I Q 107). The only individual testing below 14 runs a successful delicatessen establishment. There is no doubt about his inferior intelligence (I Q 81), but he is exceptionally industrious and is aided by a wife who is reputed to be "the brains" of the business. This was the only I Q below 88. The group as a whole presents an interesting contrast with the unskilled and semi-skilled groups tested by Waugh and Flanders.

Tests of college students. Stanford-Binet tests were given under the direction of Coover to 62 students in a psychology class at Stanford University. The group was fairly representative of the student body above the freshman year. The distribution of I Q's was as follows:

I Q's	85-89	90-94	95-99	100-104	105-109	110-114	115-119	120-122
Number		1	1		13	17	20	5

The median I Q was 113. One fourth tested below 108 and one fourth above 117. The lowest I Q was 94.

Dr. June Downey tested 42 freshmen and 49 upperclassmen of the University of Wyoming.[1] The median scores for the three groups were: Freshmen, 16–8 (I Q 104); upperclassmen, 17–2 (I Q 108). The I Q distribution for all of Dr. Downey's students taken together was as follows:

I Q's	85–89	90–94	95–99	100–104	105–109	110–114	115–119	120–122	Median
Number	3	4	7	27	17	21	8	4	106

Dr. Downey found for the members of her psychology class a correlation of .527 between I Q and her own estimates of intelligence (previously made). In regard to the relative accuracy of the tests and her ratings, Dr. Downey adds: "More intimate acquaintance with the class convinced me, moreover, that the I Q's were much more accurate than my unaided judgment. In a number of instances I was able to determine just the factor that had led me astray."

In a majority of cases the results of the tests agreed fairly well with class marks. Of the seven freshmen who tested below I Q 94, only one returned for work the following year. "This is her third year in the freshman class, a hopeless drifting from one department to another."

[1] Downey, June E., "The Stanford Adult Intelligence Tests," *Journal of Delinquency*, 1917, pp. 144–55.

As would be expected, some students did much better or much poorer work than the I Q would suggest. The following are typical cases of such disagreement:

"Young man. Passed every test in the scale, but is noted for his many failures in courses. His reputation in college is that of a young man of ability who chooses to turn his talents in other than academic directions."

"A girl, whose very poor work led us to expect a record very much lower than she gave. Shyness and indifference are, I believe, the cause of her poor work. A little extra attention in class convinced me of the accuracy of the test results." She is described as having ability to give "precise and brief answers to questions" and to "hit the nail on the head once her interest is aroused."

The tests of college students justify the conclusion that the student bodies of colleges and universities are recruited mainly from those whose intelligence is considerably above the median for people in general. This is true to an even greater extent than the I Q's found would indicate, since, as we have explained elsewhere (p. 147) the Stanford-Binet does not adequately measure adults of exceptionally superior ability. In all probability the large majority of college students would as children in the grammar grades have tested between 100 and 130, with a median of perhaps 115 to 120. A certain number would probably have tested between 90 and 100, but the chances are remote

that a child testing much below 90 will ever be able to satisfy the requirements for college graduation. Children who test below 100 should ordinarily not be encouraged to look forward to entrance into law, medicine, the ministry, engineering, teaching, or any other profession which demands a high degree of ability in abstract or conceptual thinking. Substantial success in such professions is probably achieved only by individuals above the 115 or 120 I Q class.

Tests of social and industrial failures. Knollin tested 154 "migrating unemployed" men who sought temporary shelter at the "hobo hotel" of Palo Alto, California. Many of these were tramps by profession; some were merely traveling by foot to other parts of the State in search of employment. The mental ages found were as follows:

Mental ages	7 to 7–11	8 to 8–11	9 to 9–11	10 to 10–11	11 to 11–11	12 to 12–11	13 to 13–11	14 to 14–11	15 to 15–11	16 to 16–11	17 to 17–11	18 to 18–11
Number	1	3	4	5	16	16	27	28	24	15	10	5

The median mental age was 14–2 (I Q 89). The lowest 25 per cent were below 12–7 (I Q 79), the highest 25 per cent above 15–8 (I Q 98).

Johnson gave the Stanford-Binet tests to 107 destitute men picked at random from the unemployed cared for by various social service organizations in Portland, Oregon.[1] The following mental ages were found:

[1] Johnson, Glenn R., "Unemployed and Feeble-Mindedness," *Journal of Delinquency*, 1917, pp. 59–73.

Mental age.......	7	8	9	10	11	12	13	14	15	16	17	18	19
Number..........	2	0	4	7	6	9	17	19	12	10	9	9	3

It will be seen that the proportion of low-grade cases is larger in the unemployed groups than for conductors, motormen, salesgirls, or express company employees. About 5.5 per cent of Johnson's group test below 10 years, and 12 per cent below 11 years. The corresponding figure for Knollin's group are 5.2 per cent and 8.4 per cent. However, so many of the unemployed have average or superior intelligence that the median mental age for the two unemployed groups combined is 14–3, and the median I Q 89. This median exceeds that found for street-car men, salesgirls and the San José civil service applicants, but is considerably lower than the median for business men and railroad engineers.

From the point of view of vocational education and vocational guidance the above facts are very significant. Plainly, unemployment in the case of the large majority of these men is not accounted for by their lack of intelligence. More than 60 per cent had intelligence fully equal to that of the average of the 82 regularly employed street-car employees. At least 10 per cent of them were the intellectual equals of the average Stanford University student, and probably 25 per cent were intellectually capable of graduating from a high school.

Even prisoners and juvenile delinquents, among

whom the proportion of feeble-mindedness is admittedly high, are more often than not well within the bounds of intellectual normality. From the scores of studies of prison and reform-school inmates, the data of Williams may be presented as typical. The mental ages found among 184 delinquent youths over sixteen years of age at the Whittier State School were as follows:

Mental ages	7 to 7-11	8 to 8-11	9 to 9-11	10 to 10-11	11 to 11-11	12 to 12-11	13 to 13-11	14 to 14-11	15 to 15-11	16 to 16-11	17 to 17-11	18 to 18-11
Delinquents	1	3	13	28	31	33	32	16	9	12	6	

The median mental ages for these delinquents is 12-6, and the median I Q 78. Probably two thirds of the entire number are intelligent enough to make good unskilled workers. Similar facts were found in the case of 150 consecutive entrants at the San Quentin State Prison, California, who were tested by Knollin. Nearly half of the prisoners were equal in intelligence to the average street-car employee (semiskilled labor) while several were as intelligent as the average college student.

Those who have made psychological studies of juvenile delinquents, prisoners, and the unemployed have placed the emphasis upon the large amount of feeble-mindedness found. All will admit that a large proportion of both groups are defective or border-line cases, — perhaps 20 or 25 per cent of prison and reform-school inmates and possibly 10 per cent of those out of

employment in an average city under average economic conditions. It would be a serious mistake, however, if our concern over the necessity of social control for defectives should lead us to overlook the large majority in both groups who, as far as intelligence is concerned, may be considered potential social assets of great value. It would be interesting to know to what extent the failure of such individuals could be prevented by such measures as vocational education, vocational guidance, and courses of study sufficiently differentiated to fit the abilities and to satisfy the interests of all the children who are above the deadline of mental deficiency. It will be noted that 45 per cent of Johnson's unemployed and not far from 70 per cent of the delinquents fall within the range 70 to 89 I Q. This is the range which furnishes the majority of school dullards. When we investigate the school histories of men who test between 70 and 80 we are almost certain to find a record of low marks, failure, and serious retardation. Those of the 80 to 90 class have usually failed less seriously, but have rarely shown the ability to get much beyond the eighth grade. The majority of the 70 to 85 class have left school between the fifth and eighth grade with little preparation for life or life's work. It is no wonder that many fail and drift easily into the ranks of the anti-social or join the army of Bolshevik discontents.

For convenience the I Q distributions of the various vocational groups described in this chapter are brought

together in Table 40. The scores of 6 railroad engineers and 4 department-store " buyers " are thrown in with those of Knollin's 30 business men. The data for Knollin's hoboes and Johnson's destitute men are also combined, as the I Q distributions were about the same for the two groups. For each group the median I Q is given, also the I Q which marks off the lowest fourth of those in the group.

Vocational group	Per cent in each I Q group										
	No. cases	50–59	60–69	70–79	80–89	90–99	100–109	110–119	120–122	Median I Q	Lowest fourth below
College students...	153				1.9	8.5	40.5	43.1	5.9	109	104 I Q
Business men.......	40				7.5	37.5	42.5	12.5		102	97 I Q
Express employees	47		4.3	4.3	23.4	19.1	19.1	17.2	12.7	95	87 I Q
Motormen and conductors....	82		3.7	23.1	30.5	32.9	7.3	2.4		86	79 I Q
Firemen and policemen.......	30		6.7	26.7	36.7	20.	6.7	3.3		84	78 I Q
Salesgirls...	61		8.2	29.5	24.6	26.2	8.2	3.3		85	77 I Q
Hoboes and unemployed.....	256	5.4	14.1	21.1	26.9	16.	9.7	5-1	1.1	89	71 I Q

TABLE 40. I Q DISTRIBUTION OF VARIOUS VOCATIONAL GROUPS

Educational guidance. In vocational guidance the best that intelligence tests can do is to indicate roughly the vocational level in which success is possible. The final choice of a vocation must be determined largely by interest and opportunity. For all we know, law, medicine, engineering, teaching and the ministry make about equal demands upon general intelligence. Per-

haps carpentry, masonry, plumbing, blacksmithing, etc., require about the same amount of intelligence as dozens of other skilled trades. However, intelligence tests can tell us whether a child's native ability corresponds approximately to the median found in the professions, the semi-professional pursuits, the ordinary skilled trades, the semi-skilled trades, among unskilled laborers, etc., and this information is of great value in planning a child's education. It is accordingly in educational guidance that intelligence tests have their chief value.

Tables 28 to 35 (pp. 159–162) have shown the school progress that may be expected of various grades of intelligence, and the facts set forth in other chapters have indicated the relation of intelligence to elimination and to the ability to master high-school or college courses. The universal testing of school children would save many a disappointment. A certain woman of intelligence and education has a daughter who at the age of seventeen years tested at 78, and was still in the seventh grade. Yet the mother had not given up the hope that the daughter might become a stenographer. A college professor with a twelve-year-old son who tested at 83 was planning to send him through college. The boy will be fortunate to complete the eighth grade. Such children are sometimes badgered and urged on until life is a burden. The son of a certain lawyer has always tested at 80 to 85. He wishes to become a gardener, and his profitable success in

tilling numerous vacant lots sufficiently attests his ability in this line. The father, however, insists that his son must have a college education. To this end he scolds, coaxes, and employs private tutors. His best efforts, however, have only brought the boy to the second year of high school at the age of twenty years. The boy comprehends nothing that he is taught and keenly dislikes school.

On the other hand, it is by no means uncommon for exceptionally bright children to be apprenticed early to occupations which require but mediocre intelligence. Anything above 85 I Q in the case of a barber probably represents so much dead waste; yet we know a barber who is as intelligent as the average college student. Although in our country the industrial lines of cleavage are not rigid enough to prevent ready shift from one occupation to another, provided one determines to make the shift, it must not be forgotten that, after all, men are largely creatures of habit and after a certain age do not find it easy to adjust to the requirements of a new vocation. If we knew the total waste of mental ability we should probably be appalled. The waste is probably enormous in the case of women, because of the limited number of vocational opportunities open to them.

The conservation of talent. A nation's intellectual assets are the most precious it will ever have, and the principle of conservation will find here its most useful application.

In the conservation of talent the teacher occupies a strategic position. It is her duty to foster in a pupil the highest ambitions which are consonant with his intellectual endowment. To expect that she will be able to estimate a pupil's endowment accurately enough by mere observation is to expect too much. We have known so many bright children who were seriously underrated by their teachers that the necessity of the test method, as a supplement to observation, seems hardly open to question. If tests were more commonly given we should probably find many children like the following:

A. B. was twelve years old and in the sixth grade. He was failing, or at any rate his work was unsatisfactory to the teacher. As a matter of fact she did not promote him at the end of the term. The father consulted Mr. Virgil E. Dickson, the psychologist of the city schools, who gave the boy a mental test. The I Q was approximately 140. Apparently A. B. had a grade of ability not equaled by more than one child in two hundred. Inquiry disclosed the fact that the boy had formed a dislike for his teacher. This teacher required her pupils to copy from the dictionary the definition of all the new words encountered in each lesson. When A. B. said he knew all the words she accused him of untruthfulness. In reality his vocabulary was equal to that of the average teacher. The case deserved radical treatment and got it. Mr. Dickson, notwithstanding the boy's non-promotion in the

sixth grade, arranged for him to skip both the seventh and the eighth grade and to enter high school immediately! He did so, and passed all his work with good marks. For some months his teachers were not told of the heresy that had been committed, and they never suspected that the pupil had not come to them in the usual way. Cases of this kind suggest an explanation for the traditional but incorrect belief that a majority of great men and women were dull or mediocre in childhood.

CHAPTER XIII

PRACTICAL SUGGESTIONS FOR THE USE OF MENTAL TESTS[1]

Teachers must learn to use tests. Unless the rank and file of teachers learn to use tests the universal grading of children according to mental ability will remain largely a Utopian dream. We cannot agree with those who hold that Binet tests should not be attempted by teachers. Teachers are universally encouraged to use such educational measurements as the Courtis tests, handwriting scales, and tests of ability in reading, history, and composition. Yet, it is fully as difficult to learn the correct procedure for a "battery" of six or eight standard educational tests as to acquire a reasonable facility in the use of the Binet scale. It should be emphasized, however, that wherever possible the use of both educational and intelligence tests should be supervised, either by a psychologist or by some one else who has had extended experience in their use and in the interpretation of results. It is here that the psychologist finds his proper task, rather than in giving the tests himself. The public school psychologist, for example, cannot himself give more than 800 to 1000 Binet tests in a

[1] See also Terman, Lewis M., *The Measurement of Intelligence.*

school year, but he can supervise the testing and grading of 10,000 by taking advantage of the help which teachers can give. This method not only increases the number of pupils who will be graded more nearly in accordance with their abilities; it also effectively stimulates the teacher's interest in her children.

Preparation needed for Binet testing. However, no one should attempt to use the Binet scale without careful preparation. The training needed can be given effectively in the normal school. A half-year course of three lessons per week, or a somewhat shorter course with five lessons per week, will serve the purpose if it is properly supplemented by other courses in educational psychology. Such a course should (1) introduce the student to the nature and extent of individual differences among children; (2) show the bearing of these upon school grading; (3) explain the fundamental principles underlying intelligence testing; and (4) give a fair degree of mastery of the Binet procedure. The use of at least one scale for group testing should also be taught. The course should include actual testing by the student as well as demonstration tests. Courses of this kind should be considered an indispensable part of the normal-school curriculum.

Meanwhile, what about the teacher in service who has not had the advantage of such instruction? Must she continue to rely on guesswork for the classification of her pupils? A fairly extended experience has convinced us that this is not necessary. With a little

help the average teacher can prepare herself to use standardized mental tests accurately enough for practical purposes. If there is a psychologist in the school system the problem can be solved by forming Saturday or afternoon classes for giving the needed instruction. If no psychologist is available, some one else can often be found in the school system who is capable of directing the work, perhaps the director of special classes, or a principal who has had some training in the use of tests. A six-weeks course in a summer session of a normal school or university will also provide the necessary training.

How to learn the Binet procedure without instruction. If no help is available the earnest teacher need not hesitate to undertake the task alone. It is best to begin by first mastering the contents of two or three books dealing with individual differences and the principles of mental testing. Then the Binet procedure should be carefully studied. Merely to read through a description of the tests is not sufficient. The directions should be studied with the closest attention to the finer details of procedure, and to the method of scoring, computing mental age, etc. The significance of mental age as a basis of school grading and of the I Q for forecasting a child's later development should receive special attention. Actual testing may then be begun, preferably with the help of the Record Booklet prepared for use with the Stanford-Binet Scale. This contains appropriate spaces for

the verbatim recording of results, and gives abbreviated directions for scoring. It also saves memory strain and prevents error by supplying the exact wording for many of the tests.

After testing one or two children the instructions should be read through again, and each step in the procedure noted. This always brings certain points into relief which have escaped notice. By thus checking up her procedure after each test the teacher will acquire a sureness and a degree of accuracy which nothing else can give. After fifteen or twenty tests the mental age secured should be substantially the same as a trained psychologist would get, assuming that the teacher has studied the directions with conscientious care and has learned not to take liberties with them.

It is necessary to understand, from the very beginning, that an apparently trivial alteration of a test may so change its nature as to invalidate the results. The formula for each test should be adhered to strictly. Questions should ordinarily not be repeated except when the instructions indicate that it is permissible to do so. It is necessary to avoid leading questions and other forms of unintentional aid. If the child's answer is not clear, the question "What do you mean?" is usually sufficient and is practically the only form of supplementary question allowable.

A free and easy manner with the child should be assiduously cultivated. Timidity must be overcome

so that the child will do his best without undue coaxing. If the child's confidence is to be gained, it is necessary to take his efforts seriously, however absurd they may appear. Attention should never be called to errors. Apart from such some vague commendation as "You have done beautifully," etc., the child should be told nothing of the result of the test.

The examination should be thorough. It should extend down the scale far enough to include at least one year in which there is no failure, and up far enough to include at least a year in which there is no success. By using only the six regular tests in each year the examination can ordinarily be completed in thirty to forty minutes with younger subjects, or in fifty minutes with older ones. With subjects of the high-school level a little more time is occasionally necessary. At first the time is prolonged by the recording of replies, which should always be done as nearly as possible *verbatim*. A little experience and the liberal use of abbreviations soon enables one to do this without retarding the examination appreciably.

Learning to score. The responses, if recorded, should be scored immediately after the examination has been completed. If responses are not recorded, the scoring must be done as the examination proceeds. Wherever there is the slightest doubt as to the satisfactoriness of a response, the guide should be consulted *and followed.* Since the scale has been standardized on a definite basis of scoring, it is evident that unless

this rule is adhered to, the resulting mental age and I Q lose their significance. The teacher must learn to suppress her personal judgment as to how a test *ought* to be given or scored, and to ask only the question how it *is* given. With conscientious effort the errors of scoring can soon be reduced to a reasonable minimum.

If a psychologist is available, the teacher's scoring should be checked up from the written responses until the right habits have been thoroughly established. This is the method followed by Dickson, who writes as follows regarding the errors made by twenty-one Oakland teachers in scoring several hundred tests:

"Before the testing was begun, six lessons of 1½ hours each were given. Each teacher then tested her own pupils, and graded and marked her own tests. I then graded the tests myself, with the following results:

No correction of mental age necessary	68.2 per cent
Correction of 2 months.............	20.4 per cent
Correction of 4 months..............	10.8 per cent
Correction of 6 months..............	0.6 per cent"

This excellent record is explained in part by the fact that the subjects were all first-grade pupils, so that the teachers were not compelled to learn the procedure and scoring for the tests below four years or above ten. It will be noted that hardly any errors necessitated a correction of more than 4 months in mental age. For the average first-grade child an error of this

amount would affect the I Q to the extent of only 5 points.

We have elsewhere reported the errors of five university students in scoring 843 Binet tests.[1] The mental ages as computed by the students were correct

within 2 months in 84.8 per cent of cases;
within 4 months in 95.5 per cent of cases;
within 6 months in 98.6 per cent of cases.

The average error in I Q was about 1 point. Approximately one third of the necessary corrections were due to arithmetical mistakes in counting the number of "plus" marks, adding months of credit, or dividing mental age by chronological age. Practically all of the errors of more than 6 months in mental age, or of more than 5 to 8 points in I Q, were of this preventable kind. The counting and adding of credits and the division for I Q should always be done twice for each subject.

Tabulation of the errors in scoring the separate tests in the scale showed that two tests were responsible for 30 per cent of the errors. These were the ball and field test and the description and interpretation of pictures. Others which gave rise to frequent errors were the following: — definitions by use and superior to use, interpretation of fables, the comprehension questions, the diamond, designs, and definitions of ab-

[1] Terman, Lewis M., "Errors in Scoring Binet Tests," *The Psychological Clinic*, 1918, pp. 33–39.

stract terms. The directions set forth in *The Measurement of Intelligence* for scoring these tests should be consulted again and again until they have been thoroughly mastered.

The interpretation and use of results. To acquire a reasonable degree of expertness in giving Binet tests is a much simpler matter than to learn how to interpret and use the results. We have written this book primarily to show concretely the significance of mental age and intelligence quotient in the grading of school children. While its careful study should aid the amateur to avoid gross errors in the use of results, there is much which experience alone can bring and much which only those of psychological training can acquire. In cities which employ a school psychologist the problem is simple enough; the teachers can make the tests and leave it to the psychologist to interpret the results and to utilize them in the classification of children. If there is no recognized expert in the school system the teacher must work with caution. She must learn to consider her interpretation of the test in a tentative light, and must avoid the risk of passing judgment in doubtful or apparently pathological cases. She must understand clearly that the mere ability to give a Binet test acceptably gives her no claim to the title "clinical psychologist." If she will use the test simply as a means of getting a more accurate idea of a child's mental ability than she could get in any other way, she will be amply rewarded.

For obvious reasons the teacher should use discretion in talking about the results of the tests. That the child should not be told his mental age or I Q has already been emphasized. The teacher will also find that it is generally unwise to discuss the test results with parents in very specific terms. Such expressions as "exceptionally bright," "mentally retarded," or "slow to learn," are usually harmless; but expressions like "dullard," "feeble-minded," "border-line," etc., should be avoided. Even if the parents know the child to be feeble-minded they resent the teacher's saying so, justly feeling that the diagnosis of mental defect is not within her province. This is the rule, but of course there are exceptions. The tactful teacher who has the confidence of the mother can sometimes talk with her quite frankly about the defects of her children. The teacher's attitude should always be one of sympathetic helpfulness. Levity or cynical remarks about the dullness of a pupil should always be avoided. It is best not to discuss I Q's and mental ages of individual pupils too freely among acquaintances or even among colleagues. One never knows when or where a chance remark will be repeated.

Above all, the teacher must learn not to interpret the results of her tests too literally and not to depend upon them too exclusively. The child is not all intelligence; his fitness to take up the work of a given grade is determined partly by such factors as health, industry, attitude toward school work, and regularity of at-

tendance. Immediate and wholesale re-grading of the school on the basis of mental age as soon as the tests have been completed is not recommended. It is best to begin with individual children who are most seriously misplaced, especially the very bright, who are nearly always one or two grades below where they belong. As one after another of these is found to continue to do good work after extra promotions, the teacher will gradually acquire confidence in her judgment and in the verdict of the tests.

It is necessary, however, to avoid the danger of making a fetich of the I Q, which we have shown to be by no means infallible. An I Q of 85, for example, means no more nor less than that the child tested later will probably be found between 80 and 90. It does not mean that he *may* not later test as high as 100 or as low as 70, although the chances are roughly 22 to 1 against his doing so. Because of the possibility of such errors, however, it is necessary to check up the results of the tests in every possible way. The test should mark the beginning, not the end, of the teacher's study of a given child. As a point of departure the intelligence test is of great value; accepted as a final verdict it may lead to mistakes and disappointment. Children who cannot do the school work within at least one year of that corresponding to mental age should be studied. Usually a reason will be found. Perhaps the child lacks self-confidence. Possibly because of timidity his school work has not shown up at its full value.

Perhaps there has been lack of application. Whatever explanation is found, the teacher will understand the child in a way that would never have been possible without the insight which the test gives. Cases which continue doubtful or puzzling should be re-tested.

The use of supplementary data. Before beginning her tests the teacher should secure the following data for each child:

1. Age, in years and months;
2. Years in school;
3. Record of illnesses;
4. Nationality of each parent;
5. Occupation which supports the family;
6. Data regarding the child's brothers and sisters.

It also greatly enhances the value of test results if these can be compared with ratings based on observation. For this purpose the teacher should rate each of her pupils for quality of school work, general intelligence, and two or three personal traits like dependability, social adaptability, conscientiousness, etc. The ratings should be made on the basis of either a five-fold or seven-fold classification, as follows:

Five-fold classification	Seven-fold classification
1. Very superior	1. Very superior
2. Superior	2. Superior
3. Average	3. High average
4. Inferior	4. Average
5. Very inferior	5. Low average
	6. Inferior
	7. Very inferior

The ratings should, of course, be made in advance of the tests, in order that they may represent an independent judgment. Their comparison later with the test results will prove of surpassing interest. One pupil tests lower than he was rated, another higher. Why the discrepancy? In solving such problems, a good many of which are sure to arise in the testing of forty pupils, the teacher will gain an insight into the mentality and character of her children that will richly repay her for the somewhat difficult task of making the ratings.

The teacher will find it especially interesting and instructive to compare her trait ratings with the I Q's later found in the tests. By doing so she will see the close correlation which usually exists between desirable traits. Notwithstanding occasional exceptions to the rule, she will find that usually the child she has rated high in conscientiousness, obedience, will power, sense of humor, etc., will earn a high I Q in the Binet test; the child she has rated low, an inferior I Q.[1] In this way she will come to appreciate the close connection which often exists between unsatisfactory conduct and inferior intelligence. In connection with the other supplementary information the teacher will find it instructive to compare the I Q of the various nationalities and occupational groups represented in her class.

The Providence example. The city of Providence, Rhode Island, offers an excellent illustration of what

[1] See Figures 15, 16, and 17, p. 59.

may be accomplished by training teachers in the use of mental tests. Under the leadership of Mr. Richard D. Allen, Director of Vocational Guidance, and of Miss Greene, Supervisor of Primary Instruction, large numbers of the teachers of that city have been taught to give Binet tests. The instruction is given in a four-weeks course in the summer normal school, and includes twenty practice tests. A teachers' club of two hundred members has been formed for the purpose of promoting the grading of school children by mental ability. Miss Greene's work in testing first-grade children has already been mentioned.[1] Mr. Allen has kindly sent us the following information regarding this experiment:

I found that at the beginning of my work with the tests there were a great many puzzling things. For example, I occasionally found pupils who tested low and were nevertheless doing fair work. In such cases when I took the mental age into account I usually found that this was above the mental age of the children with whom they were competing. The facts were then easy to explain. I have yet to find a single case of the two thousand tests we have made in which the I Q and mental age do not throw valuable light upon the reasons for success or failure.

Our tests show that 90 per cent, at least, of school retardation is without doubt due to mental inferiority. There are very few seriously retarded children who do not do satisfactory work in school when they are placed in a grade which corresponds to mental age. One of the results of placing children of the same mental age together has been the cutting down of failures by fully 50 per cent.

[1] Page 64.

We have arranged to give an intelligence test to every child who leaves school to go to work, and we use the test in determining roughly the limits of the child's vocational possibilities. We have found, for example, that retarded boys who drop out of the fifth or sixth grade because of lack of ability to do the work often succeed well at painting or plain carpentry. The boys who test higher have, of course, a wider range of vocational possibilities.

Concerning one group of 1016 children whose mental- test and school work had been compared, Mr. Allen presents the following facts :

1. Of sixty-seven who tested below 70 I Q, sixty-three made an average school mark of D or E. Of two hundred who tested above 110 I Q, only four had an average school mark as low as D.
2. Of the sixty-nine pupils testing below 70, all except seven were located in a grade *above* that corresponding to mental age. Of eighty-four pupils testing above 120, every one was located in a grade *below* that corresponding to mental age. Many were below-grade as much as three, four, or five years.
3. Of one hundred and three children who are located in a grade either one and a half or two years above that corresponding to mental age, over 90 per cent are failures.
4. A great majority of the children who test under 90 I Q never graduate from the grammar school.
5. There is clearly a very close relation between the placement of a child in school and the quality of work he is able to perform. Scholarship plus chronological age plus the grade in which a child is located gives a fairly good basis for estimating the child's mental age. Conversely, the I Q plus the mental age plus the grade gives a fairly clear estimate of the quality of the work which the child should be able to do.

Getting the testing done. The earlier in the term the tests are made the greater their value. Since the testing must ordinarily be done out of school hours, it is likely to be two or three months before the teacher can complete her "pupil survey." One test each afternoon will dispose of the difficult cases within a few weeks, and of the entire class in a month or two. Sometimes Saturdays can be utilized to advantage by making special appointments with pupils to come to the school for the purpose. Children invariably like to be tested, and are always willing to forego an hour of play for the experience. The teacher will not long regard the work as an additional burden. The interest in seeing how the different children respond to the same tests grows to the point of fascination. The work is also made easier by noting how the experience adds to the pupil's feeling of intimacy toward the teacher. To test a child skillfully nearly always means to win a devoted little friend.

The tests should be made, however, even though they can only come at the middle or end of the term, as the results can be used to great advantage in deciding doubtful cases of promotion or double-promotion. The teacher should record the results in full for each child in a little book to be kept in her desk for handy reference. The record should include, after the child's name, the age (in years and months), the mental age, the I Q, the nationality of each parent, the occupation that supports the home, and the various ratings on school work, intelligence, and other traits. If educa-

tional tests have been given, the results of these should be recorded here also. The teacher who keeps such a record will soon come to look upon it as indispensable.

The testing should be carried on in such a way as not to excite undue comment among the pupils. The teacher will, of course, refrain from speaking of the tests as "intelligence tests." She may refer to them merely as "tests to see what children can do." She can avoid creating apprehension by beginning with the brightest pupils. She will thus prevent the idea getting abroad that to be given a test means to be suspected of mental inferiority. It is never advisable or necessary to test a child against his will. After a few have been given a test the others are invariably anxious to have the same privilege.

The use of abbreviated tests. When possible each child should be given a complete Binet test, but if time does not permit this the teacher can make a fairly satisfactory survey of her pupils by means of an abbreviated form of the scale which requires no more than ten to twenty minutes per pupil, according to the form of abbreviation used. Although the brief test falls a good deal short of the complete test in reliability, it is far better than nothing.

The following abbreviations of the Stanford Revision will be found serviceable:

1. The four tests of each year group (six in year 12) indicated in the record booklet by stars. Time required, approximately 30 minutes.

2. Any three tests chosen at random from each year group (but four in year 12). Time, approximately 20 minutes.
3. The vocabulary test alone. Time, 8 to 10 minutes.

When fewer than the regular number of tests are used in a year group it is of course necessary to increase the value of each test in months in proportion to the reduction of number. In the year groups below 12, each test has a value of 2 months when all six are used in each year, of 3 months when four tests are used, and of 4 months when only three tests are used. The same principle holds in the upper part of the scale. In year 12, for example, each test has a value of 3 months when all eight are given, of 4 months when six are given, and of 6 months when four are given. Perhaps the surest way to avoid errors of weighting tests is to follow the rule of giving either all the regular tests or only half of them in each year. If only half are given, the regular weighting would of course be doubled and the tests of the different year groups would have values as follows:

Years I to X	4 months
Year XII.	6 months
Year XIV	8 months
Year XVI. .	10 months
Year XVIII.	12 months

This form of abbreviation can be given to younger children in fifteen to twenty minutes. Either the first half of the tests can be given in each year group, or they can be selected according to the limitations of

time or the preference of the examiner. Otis[1] has determined statistically the reliability of either half of the Stanford-Binet Scale, when it is thus split in two vertically. His study shows the probable error of an I Q to be about 4.5 points when half the scale is used and about 3 points when all of it is used. This means that in fifty per cent of the cases the I Q found when half the scale is used would fall within the range of 4½ points above or 4½ points below the true I Q; and that the I Q found when the entire scale is used is in fifty per cent of cases within the range of 3 points above or 3 points below the true I Q. Half the scale is thus accurate enough for most practical purposes.

The vocabulary test as a brief intelligence scale. Where a hasty preliminary sifting of the pupils is necessary it is recommended that the vocabulary test be used by itself. It should be given to one child at a time, taken alone, and requires on an average only about eight or ten minutes. If the complete Binet test is given later the vocabulary scores can be added in and no time will have been lost.

Mental age	7	8	9	10	11	12	13	14	15	16	17	18	19
Median vocabulary	13	18	23	30	35	41	46	51	57	62	67	73	75

On the basis of the above mental age standards, the Stanford vocabulary test gives a mental age cor-

[1] Otis, Arthur S., "The Reliability of the Binet Scale," *The Psychological Clinic,* 1919.

rect within one year in about 60 per cent of cases, and within a year and a half in 80 per cent of cases.

The teacher will doubtless be surprised that any single test requiring only ten minutes could possess this degree of accuracy. One might very well suppose that the child's vocabulary would depend upon home environment and formal instruction, that it would be an index of special rather than general ability, and that anyway it could not be accurately enough measured by a list of 100 words selected at random from the dictionary. As we have shown elsewhere, all of these theoretical objections are contradicted by the facts.[1]

That it measures general intelligence rather than special ability is shown by the high correlation of vocabulary score with Stanford-Binet mental ages. Table 41 shows that the correlation for 631 school children was .91.

The probable error of a mental age based on the vocabulary score alone is approximately 9½ months. This means that 50 per cent of the vocabulary mental ages would deviate less than 9½ months from the mental age resulting from a complete Stanford-Binet test. It would deviate more than 12 months in only 40 per cent of cases and more than 24 months in only 10 per cent of cases.

[1] Terman, Lewis M., Kohs, S. C., and others: "The Vocabulary Test as a Measure of Intelligence," *Journal of Educational Psychology*, October, 1918.

Mental age	5-9	10-14	15-19	20-24	25-26	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-95	Total
	Vocabulary																		
19													1	1	2	1	..		5
18-6										..		..	5	..	2	1	1	..	9
18										1	..	1	1	2	3	2	1	1	12
17-6										..	1	2	6	3	3	2	1		18
17										1	2	2	9	1	1				16
16-6										2	6	3	5	2	2	..			20
16									..	6	8	13	10	3	2	1			43
15-6					..			..	4	8	9	8	5	1	3				38
15					1			2	..	16	11	9	4	2					45
14-6								1	4	11	11	5	4	..		1			37
14					..		..	3	6	11	6	1	1	1					29
13-6					1	..	2	5	6	7	2	1	1				..		25
13					..	3	2	7	2	6	5						1		26
12-6				..	1	2	2	6	4	4	3								22
12				1	1	3	3	10	4	1	2		..						25
11-6				..	0	3	5	6	2	1			1						18
11			..	1	1	11	10	2	1	1									27
10-6			1	1	6	4	1	3		1									17
10	..	..	2	2	6	14	5	1											30
9-6	1	1	1	5	4	11	1	..											24
9		1	3	11	3	7	2	1											28
8-6	..	2	10	6	5														23
8	1	6	4	9	2		..	..											22
7-6	1	6	4	5			1	1											18
7	4	13	9	2															28
6-6	5	11	2																18
6	1	5																	6
5-6		2															..	..	2
	13	47	36	43	31	58	34	48	33	77	66	45	53	16	18	8	4	1	631

TABLE 41. SHOWING THE CLOSE AGREEMENT BETWEEN MENTAL AGE AND VOCABULARY SCORE. (Cor. .91)

The vocabulary is much less influenced by the cultural status of the home than one would expect. The following illustration is typical: A. B., the feeble-minded son of a college professor, is 14 years old and tests at the mental age of 11 by the Stanford-Binet. His vocabulary score alone indicated a mental age of 11–4. The exceptional language environment of this boy had raised his vocabulary only a third of a year above his general mental level. The influence of exceptionally poor language environment is also very slight. E. is a Portuguese boy whose parents speak only broken English. This boy, the brightest we have tested from a Portuguese family, tested at the mental age of 18–6 when he was 14–5 chronologically. His vocabulary score (70 words) was equal to the median for first-year college students. The extreme poverty of his language environment had not prevented his vocabulary from keeping pace with his general level of intelligence.

A vocabulary test of 100 words is sufficient to measure an individual's total vocabulary very accurately. When several different word lists of this kind are used with the same subject they give approximately the same result. The probable error of a vocabulary score for a 100 word list is about 2 words, and since each word in the list represents 180 words in the dictionary, the probable error of total vocabulary based on the test is 360 words. For example, if a subject defines 40 words correctly his total vocabulary figures

at 40 × 180,[1] or 7200 words. The chances are 50 to 50 that this subject's actual vocabulary lies within the range of 7200 plus or minus 360; i.e., between 6840 and 7560. The chances are 22 to 1 that the total vocabulary as calculated from the score in the vocabulary test will not be found to deviate from the true vocabulary by more than 1000 words.

Group tests. Above the third grade the preliminary sifting and classification can be done most expeditiously by means of some of the recently devised group tests. These can be given simultaneously to all the pupils of a class in fifty to sixty minutes. Some of the group tests have the great advantage that they require no extended training either for giving or scoring. The scoring is done mechanically by means of stencils, and requires about ten minutes per pupil. The tests can be given as a regular school exercise, and the scoring can be done at the teacher's convenience out of school hours.[2]

While no scale has been devised for group testing

[1] The Stanford vocabulary list was constructed by selecting every 180th word in a dictionary containing 18,000 words.

[2] The best scale for group testing available at present is that of Arthur S. Otis. Another, which will have a more extensive experimental basis, is being prepared by an investigating board composed of M. E. Haggerty, L. M. Terman, E. L. Thorndike, G. M. Whipple, and R. M. Yerkes. It should be ready immediately, and will be published by Messrs George G. Harrap and Co., Ltd. The investigation was made possible by an appropriation of $25,000 by the General Education Board of the Rockefeller Foundation.

which yields as dependable results as the Binet method, the group tests are deserving of wide vogue. There should be no rivalry between the group method and the individual method of testing, as each supplements the other. All the pupils above the third or fourth grade should be given a group test annually. We may confidently expect this practice to become common in the no distant future. The individual method will find its field in the first three grades, and in the more thorough examination of children in the upper grades who make exceptional scores in the group test.

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